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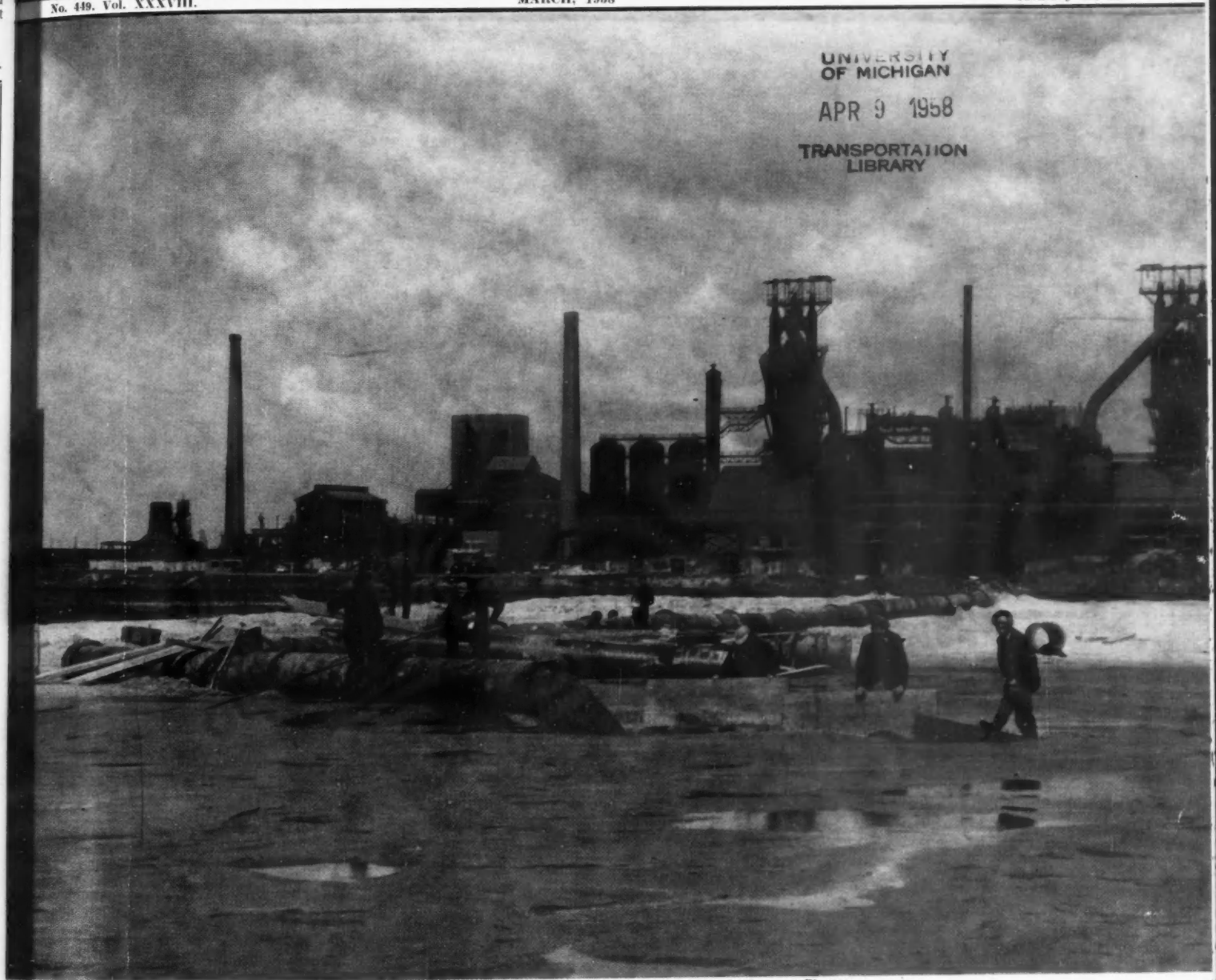

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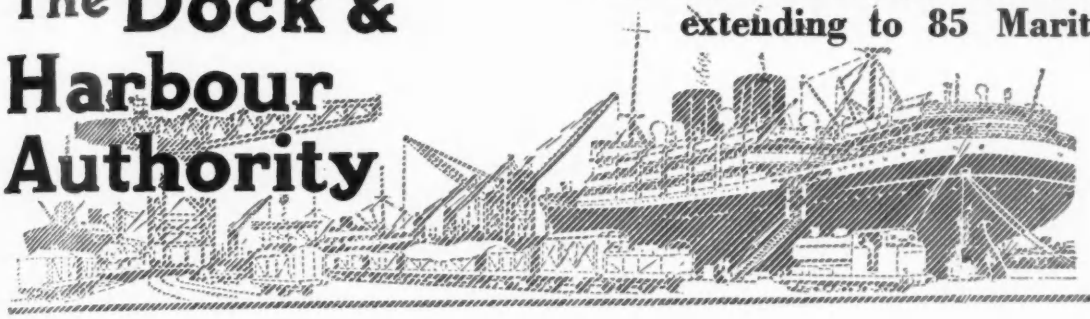


No. 449

Vol. XXXVIII

MARCH, 1958

Monthly 2s. 6d.

Editorial Comments

The Port of Abidjan

The recently developed port at Abidjan on the Ivory Coast is another example of harbour design which has been based upon the results of research carried out in an Hydraulics Laboratory. An article on the new port is included in this issue and describes in general terms the design and construction of the interesting approach canal, which has been dredged out between the land-locked lagoon whereon Abidjan town lies, and the sandy, harbour-less ocean coastline.

We hope to be able to publish at a later date further information as to how far the constricted orifice effect of the canal mouth has served to counteract the deposition of the very considerable littoral movement of sand which takes place along this coast.

The present article describes the port facilities so far provided together with the planned development work for the next five years. In common with many other West African ports enjoying small tidal range, most of the quayage is of solid construction and, at Abidjan, the very economical quay cross-section adopted takes advantage of a good clean sand substratum and back-filling and uses a selected rock fill and filter layer immediately behind the block-work walls.

The trade, economics of operation and future prospects of the port are discussed factually. The present very satisfactory position where the capital cost of port installations is being recovered in seven years' trading, must be the envy of very many Authorities responsible for the administration of docks or harbours.

The " Convenient " Flag

What is to be done about the flag of convenience? So far, as the annual report of the Chamber of Shipping comments, a satisfactory solution to this vexed problem has eluded governments, international organisations and the shipowners whose future depends on one being found. A perusal of the " Study " by a committee of the Organisation for European Economic Co-operation (summarised in later pages) draws a blank. After a masterly exposition of the situation brought about by the enormous growth of tonnage under the flags of the " Panhonlib " countries, O.E.E.C. confesses that at the moment no specific action on an international level can be advocated. The International Law Association has suggested that there should be a " genuine link " between the state and the ship flying that state's flag, but then shied away from the subject. The attempt to draw up in legal terms a definition of the minimum national element in the ownership of a ship had to abandoned.

Seamen and dockers have ignored the niceties of international usage and have on some occasions refused the despatch of " convenience " flag vessels where employment conditions for the crew in their opinion were unsatisfactory. The International Federation of Transport Workers has suggested a boycott of these ships. Even shipowners have alluded to the possibility of a freight tax, penal port dues and the like. It is clear, therefore, that the matter is now well out in the open and with so much concentration on it something ought to emerge from all the high-power thinking.

But what? It would seem that only some readjustment of taxation on shipping which would put British shipowners on a parity with their flag-of-convenience competitors would meet the case. And preferential taxation treatment might present the United Kingdom Government with a tricky problem. Perhaps notice will be taken of Mr. R. D. Ropner's forecast (qualified by considerations quite fairly put forward) that in ten years' time it will be Liberia, and not Great Britain, which will be able to boast of having the largest trading fleet in the world. In that event the earning power of United Kingdom shipping which constitutes at present a large percentage of the country's invisible exports would be in jeopardy. Where else can the Government look for £250,000,000 a year to help its balance of payments?

Mr. Ropner described the flag of convenience as " Public Enemy Number One," and this attitude is welcomed by the National Union of Seamen, the Merchant Navy and Air Line Officers' Association and the Radio Officers Union. They have issued a joint statement unreservedly supporting the " genuine link " proposal and hoping and expecting that Governments and shipowners will do likewise. " This," the statement adds " may force these tax evaders to register their ships in their own countries and thereby remove this dangerous trading manœuvre."

Technical Research

Shipowners, like dock authorities, are sometimes accused of not spending enough money on technical research. The charge in each case is baseless, and the Chamber of Shipping did well to devote part of its annual meeting to a discussion of a resolution which emphasised the continued importance of technical research to the British mercantile marine and in particular urged that in the exploration of the peaceful uses of nuclear energy, high priority should be given to its application for marine purposes. Mr. W. E. Keville dealt with the subject from the general aspect, pointing out the intimate liaison which exists between the shipping industry and the various research bodies and instancing such diverse items of equipment as lifeboats, air conditioning, the sound-proofing of bulkheads in cabin accommodation, material for ship's plumbing, floor coverings and a host of other items on which all could benefit from a pooling of ideas.

Nuclear propulsion for marine purposes was dealt with by Sir Austin Anderson. He is confident that our scientists and technicians will eventually get the right answers to the many problems involved. He reminded his hearers that hitherto the shipping and shipbuilding industries, except to the extent that they have shared in Admiralty research, have paid for their own research and experiments. Not so air transport, which contributed infinitely less to this country's net earnings of foreign exchange and which has had vast sums spent on its research by the taxpayer. Aircraft and ships were alternative and, to some extent, competitive forms of overseas transport. If the state thought it right to pay the heavy costs of incubating a revolution in the technology of one, it should presumably apply the same reasoning to the other.

Mr. A. Logan talked about some of the costly recurring items of maintenance for the hull and machinery of a ship—of corrosion control by shot-blasting the ship's plates and sections before

Editorial Comments—continued

erection on the slipway; of a practical technique to measure the surface roughness of hull steelwork; of the advantages of the completely flush welded hull; of the behaviour of a ship when she passes through restricted waterways such as canals, rivers and channels at various speeds and the degree of settling or "squat." He made one arresting observation: when nuclear power becomes commercially available for ship propulsion, instruments will be needed which are more reliable than those now employed. A stage has been reached where the human senses cannot, with the degree of accuracy required, control the plants and a fresh approach will have to be made to produce instrument-controllers with the required high degree of reliability.

Materials Handling in the Ports

The way in which goods are packed and tendered to ship loading berths often determines the way in which they can be handled in the docks. Developments in materials handling methods, particularly in the manufacturing and distributing industries are thus of much concern to the port industry, just as the methods employed at the docks are important to manufacturers and shippers. The committee of the Institute of Materials Handling had this connection between hinterland and ports well in mind when, jointly with the Polytechnic, Regent Street, London, it organised a one-day conference on "Recent Developments in Materials Handling."

In a thought-provoking introductory talk, which is printed on a following page, Sir Leslie Ford, General Manager of the Port of London Authority, emphasised the importance of proper materials handling in production and export. Subsequent speakers dealt with special aspects of the subject and extracts from a paper by Mr. E. S. Tooth on "Handling for Export" will be printed in our next issue.

Topical Notes

Increased Passenger Traffic at Dover

According to the statistics for 1957 issued by the Dover Harbour Board, 5,283 vessels, totalling 5,063,272 tons net, entered the port during the year, compared with 5,366, of 4,737,924 tons, during 1956. The total tonnage of cargo handled at the port was 991,134 tons, of which 300,546 tons was exported and 690,588 tons imported. The corresponding figures for 1956 were 981,617 tons, 288,806 tons and 692,811 tons respectively.

During the year 263,581 motor vehicles either passed through or were handled at the port. Of these, 197,419 were accompanied, 97,142 being outward bound and 100,277 inward bound; other vehicles totalled 66,162, of which 6,716 were exported and 59,446 imported. Both categories showed a substantial increase over the figures for 1956, the total of accompanied vehicles being 190,381 and the total of others 28,137 in that year.

The number of passengers embarked and disembarked totalled 1,975,692 in 1957 as against 1,786,037 in 1956.

The Port of New York Authority

In pursuance of their programme to promote international trade, the Port of New York Authority have recently opened trade development offices in both London and Zurich. This extension to their overseas representation, follows the adoption of proposals for extensive development works to be undertaken in the Port. These improvements, which will be carried out during the next five years, are estimated to cost approximately $600 million. Although a large proportion of the money will be spent on arterial roads and an air terminal project, provision of some $85 million has also been made for the improvement of harbour facilities, including the development of two miles of the Brooklyn waterfront, which will entail the replacement of twenty-five obsolescent piers by ten new piers with twenty-three berths and over 2,000,000 sq. ft. of covered warehouse space. The fifty-acre upland area will be cleared to provide a further 250,000 sq. ft of covered storage space and 45 acres of paved area. There are also extensive construction works in hand both at Manhattan and Port Newark.

Transport of Dangerous Goods by Inland Waterways

For the past two years a draft agreement on the rules of transport of dangerous goods by inland waterways has been in preparation by the Inland Transport Division of the United Nations Economic Commission for Europe. The ECE Secretariat has been assisted in this task by advice given from various European countries.

During a recent meeting in Geneva of the Group dealing with problems concerning the Dangerous Goods by Inland Waterways the outline of an agreement was drafted. This agreement will be based in its general outline on the agreement signed on the Transport of Dangerous Goods by Road (ATR) and is expected to be ready by the end of the year. Dutch, French, German and Polish experts participated in this meeting.

Improvements at Heysham

In order to improve facilities for the handling of the growing Container Traffic between England and Northern Ireland, Site work has begun at Heysham Harbour on the installation of two new full portal electric cranes on the North Quay. One crane will be of 12 tons capacity and the other 7½ tons. New crane sidings, roadways, lighting, electric capstans and new staff accommodation are also being constructed by British Railways as part of the improvement scheme, and five new train marshalling sidings are being provided. These improvements will operate in conjunction with two new container ships, one of which, the "Container Enterprise," has already been launched.

On the South Quay similar improvements are to be made to facilitate the loading and discharge of general cargo ships. There will be two new 7½ tons semi-portal electric cranes, together with associated trackwork, capstans and lighting. The total cost of the scheme will be £260,000.

New Dry Docks for Pakistan

The opening of a new dry dock at Karachi marks a further stage in the development of Pakistan's shipbuilding and repairing industry.

Completed by Gammon Ltd., for the Pakistan Industrial Development Corporation and opened in January, the new dock will considerably expand the facilities offered by the Karachi Shipyard and Engineering Company and will enable major repairs to be carried out to cargo vessels of 15,500 tons D.W. and tankers of up to 22,000 tons D.W., the dimensions of the dock being 600-ft. by 90-ft.

Covering an area of over 40 acres, the shipyard is one of three constructed by the Pakistan Industrial Development Corporation since its establishment in January 1952. The yard and engineering works was opened in the latter part of 1956 and its activities include shipbuilding and repairing, general steel fabrication work, railway wagon assembly and diesel engine manufacture. The cost of the new dry dock is estimated to be some £1¼ million.

The rapid development of this industry in Pakistan reflects the Government's urgent need to provide heavy engineering facilities to replace those lost with the ceding of Calcutta to India at the time of partition. It is given point by the formal opening of the Khulna Shipyard in East Pakistan at the end of last year. This yard covers 53 acres and is well sited to serve river transport carrying goods from Chalna and between Calcutta and East Pakistan.

Its construction was effected on schedule in four years and has cost some £1¾m. Its main features are a large slipway and eight side slips served by two 5-ton luffing cranes, two large workshops, shipbuilding hall, dry dock, foundry, power house, sawmill and an oxyacetylene plant. A channel 1,300-ft. by 300-ft. wide and 12-ft. deep has been dredged on the southern side and a quay wall has been constructed for ships under repair, complete with a travelling crane.

Some 300,000 river craft are reported to operate in East Pakistan, the majority of which require replacements or repair. Establishment of the new yard at Khulna, capable of repairing all types of Inland vessels and of constructing new river steamers of up to 750 tons will check the deterioration of river transport services experienced since partition.

The Port of Abidjan

Development of Harbour Facilities in French West Africa

Contributed by J. L. TOURNIER (Directeur du Centrifen) and translated from the French.

Introduction

THE Ivory Coast, a French West African colony, is bounded on the east by Ghana (formerly Gold Coast), on the west by the Republic of Liberia, on the north by the French Sudan and Upper Volta, and on the south by the Gulf of Guinea. Its coastline, which has a length of some 500 km., runs in an almost straight unbroken line and provides no natural protection for a harbour. The shore is difficult of access because of the submarine bar of sand which stretches along nearly the whole of the coast. Loading and unloading cargoes in open roadsteads is therefore a very difficult operation.

Beyond the shore a belt of lagoons with an average width of 4 km. extends for a distance of about 300 km. along the coast. It is separated from the sea by a littoral strip which varies in width from 800 m. to several kilometres.

Among the territories constituting the Federation of French West Africa, the Ivory Coast is one of the most richly endowed in respect of potentialities for agricultural and forestry development.

The richest portion of this territory is the forest zone which stretches along the coast to an average depth of 250 km. This low-lying coastal region yields the products that form the country's main source of wealth, viz. timber, coffee, cocoa and bananas.

Formerly, oversea trade had to rely on the open roadsteads of Assinie, Grand Lahou, Sassandra and Tabou. At a later period, wharves were built at Grand Bassam and Port-Bouet.

A system of this kind suffers from a number of drawbacks: slowness of loading and unloading operations, involving long turn-round times for the vessels; multiple re-handling of goods; the impossibility of transporting heavy indivisible loads; loss and damage to goods in heavy weather; the very high cost of handling per ton of cargo throughput.

A properly equipped port was therefore indispensable to the development of the territory.

Access Works

Since the beginning of the present century efforts have been made to find ways and means of constructing a harbour which could suitably be enlarged to meet a progressive increase in trade requirements. The solution conceived for the purpose was to dig a canal through the narrow littoral strip so as to enable ships to enter the lagoon and thus operate in calm water.

An unsuccessful attempt in this direction was made near Port-Bouet in the years 1904 to 1907. Despite this initial setback, the problem of digging a canal through the strip was again tackled in 1912, and a study was made of the natural phenomena peculiar to this part of the coast of Africa, viz. swell, currents, littoral drift, etc.

On the basis of the observations made, researches were carried out, in 1934, on a model of the proposed canal at the Hydraulics Laboratory at Delft (Holland). A large number of tests and experiments were made at this laboratory, and led to the following recommendations:

(1) A sufficiently wide and deep canal would have to be excavated so as to minimise flow resistance and to have available an adequate quantity of water to enable the ebb-tide to set up a sluicing current which would remove any sand that might tend to obstruct the canal entrance. The mouth of the canal at the seaward end would have to be provided with a raised sill, in conjunction with a reduction in width, in order to produce a kind of jet which would carry the sand out to sea. For this purpose the canal would have to be constructed to a north-west to south-east alignment forming an appropriate angle with the coastline.

(2) The mouth of the canal would have to be provided with two curved breakwaters. To protect the canal entrance from swell, the west breakwater would have to be made longer than the east breakwater.

(3) The banks of the canal and the sill at the mouth would have to be protected against erosion by means of fascine mattresses weighted with rubble.

The design for the Vridi Canal was based on the above recommendations. The contract for the job was let in September, 1936. Work commenced in 1938, but was considerably slowed down by the war. It comprised the following main items:

(a) **Excavation of the Canal.** The canal was excavated by dredging. Two suction dredgers, operating from each end, were used. One of these was a river dredger and started at the lagoon end of the channel. The other, a marine dredger, began operations at the seaward end.

The overall length of the canal from the bank of the lagoon to the sea-coast is 2.7 km. Its normal width is 370 m. at water level; at a level of −10 m. it is 300 m. wide, and at −15 m. it is only 200 m. in width. At a distance of 500 m. from the sea the channel begins gradually to narrow, until at the roots of the breakwaters its width has decreased to 250 m., whilst at the same time the level of the bottom rises to −12 m., thus forming a sill at the mouth.

View of the quays, taken from the town.

(b) **Construction of the Breakwaters.** The west breakwater has a length of 520 m. It projects a distance of 420 m. into the sea, the root portion being 100 m. in length. The rubble used for building the breakwater comprises three classes of material, viz., small fragments weighing 0—300 kg., medium blocks weighing 300—4,000 kg., and large blocks weighing 4,000—10,000 kg. The head of the breakwater is founded at a level of approximately −18 m. and is protected by a casing of 18-ton concrete blocks. The structure has a radius of curvature of 2,000 m.

The east breakwater is 180 m. in length; it projects 80 m. into the sea and has a root portion of 100 m. At a level of +3 m. the formation width is 12 m. The structure consists of two courses of 18-ton concrete blocks protected by blocks of stone weighing between 5 and 20 tons. This breakwater is curved to a radius of 120 m.

(c) **Protection of the Canal Banks.** The banks are protected against erosion by means of bamboo fascine mattresses weighted

The Port of Abidjan—continued

View of quays and transit sheds.

with 600 kg. of rock per m.^{2} Further protection is provided by two rows of rubble placed at the top of the mattresses.

(d) **Construction of a Scour Resistant Sill.** The mouth of the canal (at the seaward end) is provided with a raised sill covered with fascine mattresses weighted with 1,000 kg. of rock per m.^{2} This sill extends from a level of −12 m. down to −20 m. At the crest (at −12 m.) it is 195 m. in length. In consequence of the constriction at the mouth (due to the raised sill and to the reduction in width) the cross-section of the canal is locally reduced to little more than half the normal section. The velocity of the current at the mouth is thereby increased to 2 m./sec.—as against only 1.2 m./sec. in the canal generally—and thus has a sluicing action.

The following figures will serve to give some idea of the magnitude of the works executed:

18,000,000 m.^{3} of dredging;
1,000,000 tons of rubble of all classes;
450,000 m.^{2} of fascine mattress.

The Vridi Canal was opened to shipping in July, 1950.

Description of the Port Facilities

The canal through the littoral strip at Vridi constituted the first major development in the scheme of improving the port facilities of the Ivory Coast. The roadstead of Abidjan in the Ebrié Lagoon now provided 1,000 hectares of deep water (level of natural bottom of lagoon −10 m. or deeper), capable of accommodating a large number of vessels moored to buoys or riding at anchor. Henceforth all manner of goods could be loaded or discharged without difficulty, in calm water, with the aid of the lighterage facilities provided.

Lighters and barges ply back and forth between the ships and the old lighter quay, where the lagoon bottom level is −2.50 m. This quay, which is 520 m. in length, was constructed in 1948-1950 and is located in front of the warehouses belonging to the old Port-Bouet wharf, which were built at the south-west edge of the Abidjan peninsula.

But the above arrangements provided merely a temporary solution. At the time of starting work on the Vridi Canal it was already decided in principle to build, as a first stage, a group of deep-water quays at the north-west tip of the island of Petit-Bassam. The reason for this decision was that quays which are properly served by transport routes and are equipped with suitable cargo handling and storage facilities permit quicker and cheaper operation than is possible by means of lighters.

Construction of work on the first group of quays of the new port was started in 1951. They were put into commission on the 1st September, 1955, and comprise 1,050 m. of deep-water quays (level of harbour bottom −10 m.) and 300 m. of lighter quays founded at −2.50 m.

There are two lines of deep-water berths located at an angle of about 70° with respect to each other. The North Quay, running north-east to south-west, consists of two berths, each with a length of 150 m., viz., a general-cargo berth (east) and a berth for passenger and mail steamers (west). The West Quay, running north-west to south-east, has five general-cargo berths, each 150 m. in length. The latter quay consists of a straight length and a curved portion with a radius of 2,000 m. The adopted quay layout in no way complicates the task of manoeuvring the vessels alongside. It has the advantage of gaining more land area behind the quays, whilst ensuring that the quays themselves could be built on a sand substratum providing good foundation conditions.

The construction of the deep-water quays involved 3,500,000 m.^{3} of dredging for their foundations and for obtaining a sufficient depth of water alongside (level of bottom −10 m.). A good deal of the dredged spoil, consisting of very clean sand, was used for backfilling behind the quay walls.

The type of construction adopted for the quay wall consists of independent stacks of blocks placed side by side. Each stack is composed of four precast blocks of vibrated concrete made with a special cement resistant to the chemical attack of sea-water. The bottom block, weighing 150 tons, is provided with a toe and a heel. It is seated on a rubble base with a minimum thickness of 1.50 m. The rubble, consisting of fragments ranging in weight from 0 to 50 kg., was finished to a level surface by divers.

The other blocks in each stack are parallelepipedal in shape and weigh 125, 100 and 85 tons respectively. To obtain a positive connection between the stacks of blocks forming the quay wall, vertical lengths of rail are embedded in the topmost block and in the reinforced concrete capping beam, which has a depth of 1.90-in. The front of this beam is provided with a granite masonry facing with cement motar joints. The coping level is +3.50 m.

The quay wall is constructed to a 1 : 20 batter. A rock fill, the purpose of which is to reduce the earth pressure, is placed behind the wall. This material is covered by a filtering layer which serves to prevent the entry of sand into the voids between the fragments of rock constituting the fill.

The construction of the quay walls involved the placing of 25,000 tons of rubble and 60,000 m.^{3} of concrete.

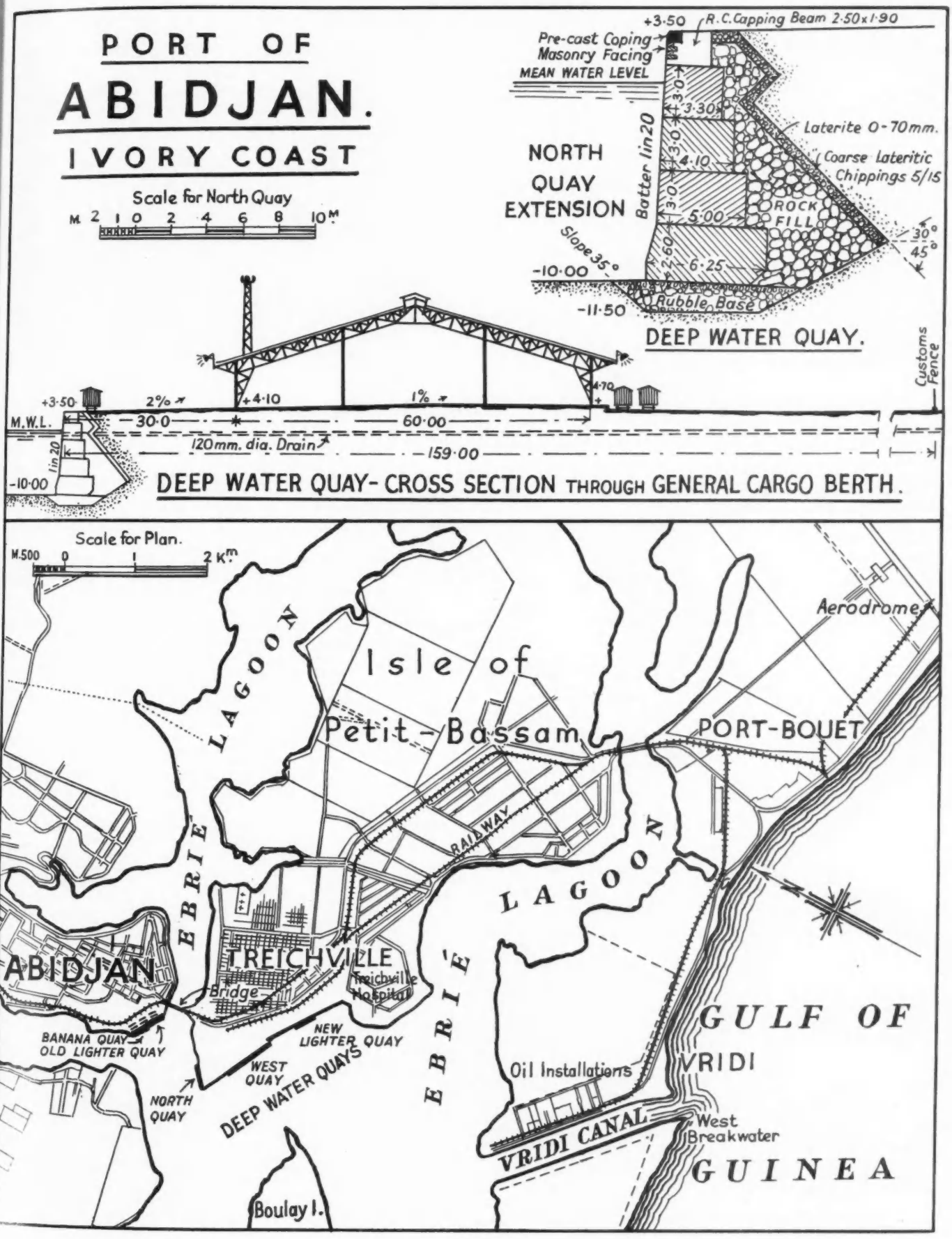
The wall of the new quay for lighters is constructed of three courses of precast concrete blocks. The wall is founded at −2.50 m.; its coping level is +2.50 m. Half of this quay is situated outside the customs fence and is now being used by fishing craft.

The customs fence encloses the North Quay, the West Quay and the north half of the new lighter quay. At the present time the following installations are in service:

Three transit sheds, 100 m. × 60 m. in size, at No. 1, 3 and 5 berths of the West Quay respectively.

A 100 m. × 20 m. shed on the lighter quay.

Entrance to the Vridi Canal, leading from the lagoon to the ocean.


PORT OF
ABIDJAN.
IVORY COAST
Scale for North Quay
M. 2 1 0 2 4 6 8 10M
+3·50
R.C.Capping Beam 2·50x1·90
Pre-cast Coping
Masonry Facing
MEAN WATER LEVEL
NORTH
QUAY
EXTENSION
Batter 1in20
3·0
3·30
3·0
4·10
3·0
5·00
2·60
6·25
Laterite 0-70mm.
Coarse Lateritic
Chippings 5/15
ROCK
FILL
30°
45°
Slope 35°
-10·00
-11·50
Rubble Base
DEEP WATER QUAY.
Customs
Fence
+3·50
2%
+4·10
1%
4·70
M.W.L.
30·0
60·00
120mm. dia. Drain
159·00
1in20
-10·00
DEEP WATER QUAY- CROSS SECTION THROUGH GENERAL CARGO BERTH.
Scale for Plan.
M.500 0 1 2 Km
Aerodrome
Isle of
Petit-Bassam
PORT-BOUET
EBRIE LAGOON
RAILWAY
EBRIE LAGOON
ABIDJAN
TREICHVILLE
Treichville
Hospital
Bridge
BANANA QUAY
OLD LIGHTER QUAY
NEW
LIGHTER QUAY
WEST
QUAY
NORTH
QUAY
DEEP WATER QUAYS
Oil Installations
GULF OF
VRIDI
VRIDI CANAL
West
Breakwater
GUINEA
Boulay I.

The Port of Abidjan—continued

Two 60 m. × 60 m. transit sheds at No. 2 and 4 berths of the West Quay. The future extension of these buildings to a size of 100 m. × 60 m. is envisaged.

A shed, 100 m. × 60 m. in size, which is under construction at No. 6 berth of the North Quay. One half of this structure will be used as a transit shed, whilst the other half will be equipped as a passenger terminal.

A transit shed, 80 m. × 60 m. in size, which is at present being extended to 100 m. × 60 m., at No. 7 berth of the North Quay.

The old temporary passenger terminal at No. 6 berth has been moved to the rear and will serve as a bonded warehouse. This building is 50 m. × 25 m. in size.

A building for the treatment and processing of produce has been put into service. The custom-house is also accommodated in this building.

The construction of the deep-water quays entailed the execution of the following ancillary works: a drainage and sewerage system for the quays and for the warehouses situated behind the customs fence; a network of underground telephone lines; water and electricity supply systems; the construction of the quay aprons and other hard-surfaced areas; the construction of road and rail facilities serving the entire dock area and providing connections to the north and south.

The special installations of the port include a quay for banana vessels. This structure is a 125 m. long wharf built on reinforced concrete piles in front of the old lighter quay at its north end. The depth of water at this quay has been increased by dredging (level of bottom −7 m.), and two 23 m. × 48 m. sheds equipped for banana handling have been built to the rear of this wharf. They are provided with belt conveyors and elevators for loading into the ships' holds the bunches of bananas which are brought to the docks by road or rail.

Economic Considerations

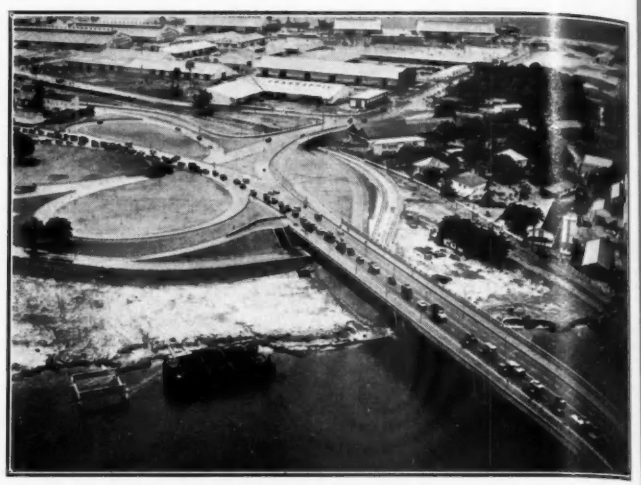
Maritime trade, which had virtually ceased following upon the outbreak of the Second World War, began to revive in 1946, but it was not until 1948 that the 1938 volume of trade was exceeded. It has gone on increasing ever since as is evident from the following figures:

Total volume of trade (imports and exports):

1938 ...	328,010 tons	1952 ...	673,482 tons
1948 ...	330,483 „	1953 ...	704,141 „
1949 ...	418,289 „	1954 ...	858,725 „
1950 ...	516,907 „	1955 ...	947,015 „
1951 ...	733,134 „	1956 ...	1,060,000 „

These figures—which do not include water supplied to ships (78,400 tons in 1956)—show how rapidly the Ivory Coast's economy is developing. The port installations constructed to date were designed in 1947 for an estimated average annual volume of trade of 650,000 tons. In view of the actual expansion of trade it is hardly surprising that the available facilities have by now become inadequate.

100-ton floating crane unloading a 20-ton fishing boat.



South end of the new bridge, completed in 1957.

It has therefore been decided to extend the North Quay to a length of 625 m., thus providing two additional berths. This is to be followed in the near future by the construction of a fifth berth, which will increase the length of the quay to 775 m. The port will then possess ten deep-water berths.

The Assinie Canal, now completed, and the Fresco Canal, for which the plans are ready, will undoubtedly add to the volume of trade passing through the port.

Furthermore, the steady increase in the number of fishing boats based on the port (8 in 1953, 14 in 1955, 22 in 1957), which is justified by the large catches due to the continuous migration of shoals of fish off the Ivory Coast, made it necessary to build a fishing harbour. This harbour is to be sited south of the Treichville Hospital. At present, the fishing boats use the south half of the new lighter quay, but this has become inadequate for the purpose.

The total present value of the maritime works in the Ivory Coast executed to date amounts to about 7,440 million francs, which figure includes 4,000 million for the Vridi Canal, 1,320 million for the quays at Abidjan, 762 million for buildings, and 604 million for plant and equipment. Calculations based on the present volume of trade show that investments in respect of the port installations will have paid for themselves in no more than seven years by the economies effected by these installations, even if the savings resulting from reduced insurance charges, more rapid turnover of capital, and lower freight charges (due to quicker turn-round of ships using the port) are left out of account.

The rapid economic development of the Ivory Coast resulting from the provision of up-to-date port facilities has led to a considerable rise in the standard of living of the native population. This is reflected in a marked increase in imports of consumer goods.

Future Prospects

The total volume of trade handled by the port passed the million-ton mark in 1956 and is steadily increasing. As already stated, the present berthing facilities were planned on the basis of an overall figure of 650,000 tons, exclusive of oil. The tonnage (not including oil) handled in 1956 was 939,164 tons. On account of the inadequacy of the existing facilities—and despite the very satisfactory results of the efforts to improve the capacity of the available berths by very efficient mechanisation of the quayside handling operations — a not inconsiderable proportion of the cargoes passing through the port still have to be loaded or unloaded in roadsteads with the aid of lighters.

(*Concluded at foot of next column*)

Recent Developments in Materials Handling

Address by SIR LESLIE FORD, O.B.E.
(General Manager, Port of London Authority)

A one-day conference for executives was held last month in London to study the problem of materials handling, a subject which is becoming increasingly important for the manufacturing, warehousing and distributing industries. The meeting was jointly organised by the Institute of Materials Handling and the Polytechnic, Regent Street, London, and as the chairman, Mr. H. M. Keegan (who is also the Institute's national chairman) reminded his audience, the object of the conference was to throw more light on a neglected and often misunderstood subject. The ability of any manufacturing or distributive concern to succeed depends to a large extent on whether it is organised to handle its material, products or goods economically, for every time material is handled it adds to the cost of the product but not a penny to its value.

The conference was opened by Sir Leslie Ford, General Manager of the Port of London Authority, who, during the day was followed by other speakers who discussed respectively (1) handling in production; (2) handling for export; and (3) handling in distribution. Sir Leslie's introductory address, which covered the whole scope of the subject in principle is of considerable interest and the following extracts are reproduced with due acknowledgment.

It is not proposed to define "materials handling" in exact terms; that has already been done in the excellent handbook of the Institute of Materials Handling. Rather, let us consider in a general way their significance in relation to our particular interests.

Would I be far wrong in suggesting that a first interpretation of materials handling is "mechanisation," to be followed almost immediately by that ugly word "automation." This in turn tends to imply the elimination of labour, with management visualising a stage of development where no further thought is necessary because the machine does all the work. This, to my mind, is a dangerous thought process. It suggests that if you buy a machine all your troubles are over. In fact, it could be that that is where all your troubles begin if you have not previously made a proper study of the efficient and economical implementation of mechanical handling into your work processes. In other words, beware of mechanising for the sake of it.

To those of you who are closely associated with and fully appreciative of this important subject, my warning may sound superfluous. However, there are to-day managements operating quite successfully, but who are prepared to buy a machine, that is self demonstrating as to its efficiency for a specific operation, and instal it without any thought as to what is happening before the material reaches that particular machine or when it leaves. It is just a loose part in a series of operations that could possibly function for a long time quite harmlessly but equally could become a serious menace because no one had readily given that essential consideration to its proper co-ordination in relation to the processes as a whole.

This island must import if it is to survive. It must therefore manufacture and export in order to pay for those essential imports. In such circumstances, it appears reasonable to suppose that every possible effort is being made continually to ensure the greatest efficiency in that export trade upon which our very existence depends. But can we honestly say that such is the case? In our own life-time we have seen the birth of new industries and new techniques. We have watched with pride the vast units of production turning out a never-ending stream of manufactured articles. The luxury of yesterday has become the necessity of to-day. We have seen the standard of living rise to heights which only a few years ago would have been regarded as prodigious.

Let us take full credit for all this progress. Let us agree that in spite of the growing competition we are still able to sell great quantities of British goods of excellent design and quality. But what is happening about the price? The thinking man knows that he must devise improved methods of manufacture, of packing, of transport and distribution if he is not to be left out of the race. He must be constantly asking himself whether the individual items of his total cost are maintaining a correct relationship with each other. To come nearer our subject, how does he "handle" and what does it cost? I venture to suggest no sphere offers greater scope for cost reduction than "handling."

It would not be unduly exaggerating the importance of handling to say that it is one of the most influential factors in maintaining our national standard of living. This is a bold statement to make, but the more you study the problem, the more you will find there is every justification for placing its importance high in the affairs of organisation and management in all manufacturing and productive establishments.

Mechanisation for its own sake, whether in part or in whole, is of no value. There must be a proper co-ordination of the several branches of industry so that each works in harmony with and complementary to the other. A factory may be equipped with the most modern forms of mass production, but this would be useless if the arrangements for the distribution of its products were not similarly streamlined. A large fleet of modern forms of transport would be impotent if the loading or unloading facilities were undertaken by a couple of men working with hand barrows. A port authority may have at their disposal modern cranes, fork-lift trucks and all the other forms of mechanical aids to labour, but if the premises are not designed in such a way that the movement of vehicles can be conveniently arranged; if the roads, quays and transit sheds are not constructed to allow the unhampered use of the equipment available, then the result must be frustration or utter confusion.

It has been said that in most industries more money is spent in picking up, transporting and storing the material before and after its manufacture than upon the actual manufacturing processes. The importance of the careful study of every phase of the work will therefore be apparent. Are the intake facilities the best that can be devised? Is the spacing on the production floor right? Too much space tends to unnecessary movement of personnel, too little to a confused and wasted effort.

After manufacture, are the packing arrangements right? Thought must be given to the size of the container, whether it be a small carton or a large case or crate. It must be designed for the use to which it is to be put. Remember that after the product has left the workshop or factory, it is going to be handled by someone who does not know and may not care what the precise nature of the product may be. Will the package fit neatly on to a standard form of pallet? Will it stow well into a railway wagon? Is the package strong enough to stand the buffeting to which it may be subject before it reaches its destination? Is the weight an economic one? Is the external marking of the package clear and legible? If intended for export, is the marking sufficient that it can reach its destination without the package being turned this way and that in order to decipher some obscure hieroglyphic? In these and many other aspects the packaging of the product must be studied to ensure that time and money spent on the production floor are not frittered away in the packing department.

The Port of Abidjan—continued

To remedy this state of affairs a loan of 645 million francs for port development has been applied for. Of this amount, 230 million francs will be needed in 1957 and 1958 for starting the construction of the two projected North Quay berths (No. 8 and 9), and a further 415 million francs will be required during the period 1958-1962 for completing these berths and for building No. 10 berth. The cost of constructing the transit sheds for the three new berths will be defrayed from local resources.

Another project which ranks high in terms of priority is the construction of the fishing harbour.

A port is never completed. It must constantly adapt itself to the economic development of its hinterland. This is particularly true of the young Port of Abidjan, whose hinterland comprises not only the Ivory Coast with its vast potentialities, but also Upper Volta and the southern part of the French Sudan.

Recent Developments in Materials Handling—continued

The docks industry, which is a main link in the transportation of goods, both nationally and internationally, has of course been handling cargoes of all types for many years. Shipowners, merchants, warehousekeepers, H.M. Customs, transport organisations, etc., all have their own particular requirements so that the problems of handling are far more complex than, for example, a factory producing a limited range of commodity with a certain measure of uniformity.

Everyone interested in the industry (dock authorities, shipowners, stevedoring firms) are forever experimenting in some way or other to improve their efficiency in handling methods and wherever possible, they have installed special mechanical equipment to deal with particular cargoes. Bulk grain elevators (static and portable), transporters, grabbing cranes, mechanical trimmers, conveyors, fork-lift trucks, pallets, squeeze clamp trucks, mobile cranes of varying capacity and design are but a few of the items. These have been evolved over many years of practical operating and I should like to emphasise that it is the general practice for the equipment manufacturers to have been consulted at all phases of any particular project.

Efficiency in our ports is one of the aims to which we must constantly address ourselves. Some of you, no doubt, can speak feelingly and expressively about lines of lorries loaded with exports having on occasions to wait for hours before being unloaded. We are alive to these facts and, bearing in mind the many restrictive influences under which we have to operate, such as labour's reactions, town planning requirements, credit squeeze, etc., we have done much, but so much more remains still to be done. If we could start to build a Port of London anew, I am sure it would look vastly different from the Port we know to-day, for it is in the planning stages when the first lines are drawn that "materials handling" must begin to assume its rightful place.

This does not only apply to a Port; it applies equally to every factory, workshop, warehouse and distribution centre in the land. I control what is to a very large extent a materials handling company, and although very considerable sums have been spent in recent years, and are still being spent, we are only on the fringe of solving the real problem. Additional equipment at the Port of London purchased since the war comprises 221 quay cranes, 189 electric trucks, 80 fork-lift trucks, 159 mobile cranes, 9,400 pallets, 2 floating elevators, 9 diesel tugs, 6 diesel shunting engines, 85 barges, etc., costing in total well over £3½ million.

The Transport and Dock Industries must play their part in the chain. Some progress has been made, but so far it has been isolated instead of having that "throughout co-ordination" which is essential if the desired benefits are to be achieved.

You are all senior executives representing a comprehensive cross section of British Industry. Many of you no doubt have a direct responsibility for this all important incidence of handling. Others may be a little more remote but nevertheless responsible for the eventual cost of the product, its sale and distribution overseas. One thing is certain—all of you are making a great contribution to our export business and your presence at this meeting is proof of your recognition of the important part that materials handling methods play in relation to production costs.

May I proceed one step further and suggest that it calls for something more than an executive awareness—it justifies the study and application of specially trained staff. In my own sphere we have several senior officers who have given and are continuing to give a lot of thought to improved handling methods, and this is not merely an operating problem. Our engineers also have a very considerable responsibility in both design and maintenance of much of our new equipment in the light of what the machine is required to do and the conditions under which it operates. I would therefore earnestly commend to senior executives the benefits to be derived from the collective study courses that are available from time to time.

May I quote from a recent editorial on this subject: "An expanding industry must of necessity have a continuously developing handling policy. That is why it is so important to employ properly qualified specialists to take charge of all technical problems relating to the handling of materials. Invariably this means that plant layout must be brought within the scope of the materials handling engineer, and often he may even have some valuable advice to give on actual product design as related to ease of handling. A firm with a handling engineer or department of the right calibre can be sure that they are making the most of the opportunities which arise from day to day in almost any factory for improving handling amenities and thus reducing overheads."

One final word, partly digressive, but to my mind of equal importance. The materials we have been speaking of could be properly described as "inert." My dictionary tells me "inert" is something without inherent power of action, motion or resistance. By the same token, machines, however intricate, are inanimate and do their work without emotion, ambition or hope of reward. Not so the men who use them, and if we are to be successful in extending the field of mechanical handling, we shall be wise to continue to be students of the arts of communication and of human relations.

It is to be expected that those who possess the facts and figures should make certain that the introduction of new methods of work will, in the long run, be for the benefit of those who work in the industry and for the wider world beyond its bounds. The man, however, who has been accustomed to work in a certain way and who knows by experience what effort is required of him and what will be the level of his reward for that effort, may, because he is doubtful of the consequences, be slower than some of us to accept the necessity for change. We need his co-operation and goodwill and these, we may hope, will be achieved in part by, to use a phrase of the Services, "keeping him in the picture" so far as is practicable. It is clear that discussions with Trade Unions and local representatives about what is proposed, and what it is hoped to accomplish, are important.

We cannot believe, however, that good communication will solve all difficulties. There will be occasions when only patience and the growth of understanding of viewpoints other than their own, by management and employees at all levels, will provide the climate in which problems can be solved. Patience and understanding come by the study of people as persons. Such study is not an optional extra, it is essential to the full attainment of efficiency and economy in industry.

Course on Materials Handling

Readers will be interested to know that a course on Materials Handling has been arranged by the Department of Management Studies of the Polytechnic. This will comprise ten weekly lectures, commencing on April 17th and continuing each Thursday thereafter.

The lectures will deal with the place of materials handling in the production and distribution system; cost of handling; economic use of labour and plant. Integration of materials handling with other operations; cost of uneven work flow; storage and despatch; design of fixtures and layout; limitations of various classes of equipment. Mechanical handling; limitations of mechanical apparatus; criteria of choice. Financial aspects of materials handling; capital costs, operating costs. Areas of saving, direct and indirect. Analysis of Problems; techniques and aids; comparison of schemes. Effects by and on Transport; integration of transport with manufacture. Case studies.

The meetings will be held at St. Katharine's House, 194, Albany Street, London, N.W.1.

Construction of new Tyne Tanker Berth

Preliminary work has already begun on the construction of a deepwater berth at Howdon on the Tyne, which is to form part of a new oil distributing centre for the Esso Petroleum Company, Ltd. to serve the North-East area of England. The installation, which will cover an area of 60 acres, will occupy the old Northumberland Dock which became redundant with the fall in coal exports some years ago. The project is expected to take two or three years to complete and will provide discharge facilities for large tankers.

Ships under "Flags of Convenience"

A Problem for Shipowning Countries—no lead from O.E.E.C.

(By a Special Correspondent)

The Maritime Transport Committee of the Council of the Organisation for European Economic Co-operation (O.E.E.C.) recently completed a "Study on the expansion of the flags of convenience fleets and on various aspects thereof." This has now been considered by the Council and it has recommended the study to the attention of all member Governments. The study adds little to present knowledge of the subject and, disappointingly, offers no solution to a problem which, in many countries, is held to be assuming the proportions of a menace. This is the conclusion reached:

At this moment no specific action on an international level can be advocated. The Maritime Transport Committee will continue to keep this question actively under consideration, and proposes to draw attention, as it has done already, to international aspects of the situation as they develop and to the possibilities of further action. It does not follow from this, however, that there is nothing that individual Governments can do for themselves to help towards a solution of this problem.

There are many traditional ties and advantages to make registration under the flags of established maritime countries attractive to their nationals. It is not unlikely that individual Governments will be compelled to take some action by which the advantage of owning ships under their flag may be enhanced. This will be all to the good, provided that it is achieved without infringing the principles of non-discrimination and economic co-operation to which the O.E.E.C. countries subscribe.

The study starts off by defining "flags of convenience" as a term commonly used to describe the flags of such countries as Panama, Liberia, Honduras and Costa Rica whose laws allow—and indeed make it easy for—ships owned by foreign nationals or companies to fly these flags. This is in contrast to the practice in the maritime countries (and in many others) where the right to fly the national flag is subject to stringent conditions and involves far-reaching obligations.

Tables are given showing the existing fleets of the world as at 30th June, 1957, and of ships under construction three months later. It is estimated that over 80 per cent. of the tonnage registered under flags of convenience belongs to owners of Greek or United States nationality or origin. It is stated that there are two main motives activating those shipowners who have adopted the practice, namely, opportunities for avoiding taxation on the earnings of ships registered under these flags and in some cases relief from high crew standards and consequent high operating costs.

Nominal Charges

There are set out the registration fees and the annual tax levied in the four countries named. While nominal for shipowners, these charges represent an important source of easily collectible revenue to the states concerned — hence their interest in the matter and the competition in offering attractive terms to ships to register under their flags.

The virtual freedom from taxation of ships sailing under flags of convenience enables many of the shipowners concerned so to arrange their business enterprises that their profits are not liable to taxation in any country. They are thus able to devote to the expansion and development of their fleets that proportion of their profits which their competitors in other countries have to set aside to meet tax requirements.

The comparatively large amount of United States owned tonnage in this group is primarily due to the lower operating costs under these flags as compared with operating costs under the United States flag. This applies particularly to crew costs, including social welfare contribution, as 75 per cent. of the crews and 100 per cent. of the officers of ships under the United States flag must be of United States nationality.

Therefore the real effect of registration of United States owned vessels under these flags is to bring the high operating costs incurred by ships registered in the United States down to a level nearer that of the general run in the countries of their foreign competitors. In a sense, therefore, it is the removal of a handicap rather than the gaining of an advantage which flows from these particulars transfers. The American unions have strongly opposed transfers of this type on the ground that each one displaces an American crew. It has, however, been the policy of the United States Government to permit them when not conflicting with the national interest. Certain obligations are stipulated in these cases, e.g., that the ships shall be placed at the disposal of the United States in case of war.

Encouragement From Oil Companies

It is particularly the oil companies, the report goes on, which have promoted the move to flags of convenience since the Second World War. In the first place, they have themselves placed a number of their tankers under flags of convenience. Secondly, they have always followed the policy of supplementing the tanker tonnage under their own control and ownership by offering long-term charters to independent owners. Some of the latter have not been slow to realise that by registration under "convenience" flags the profits from their charters become tax-free. Thus, in effect, the oil companies are encouraging the growth of the "convenience" fleets, although themselves receiving no advantages, in the case of their time-chartered tankers, from their operating under flags of convenience.

Disadvantages are noted. Owners enjoy little or no Governmental support in matters where diplomatic action would be helpful; and as a result of the action of seamen's and dockers' unions owners may be faced with difficulties in manning their ships and in loading and discharging them.

The report proceeds to compare methods of registration under flags of convenience with those in the maritime countries. It observes that in the latter countries, though they vary, they are very much stricter. Foreigners, as individuals, may not, as a general rule, register their ships on the national register. Where registration is made by a company, that company must have its principal place of business in and must be controlled from, the country where the ships are to be registered (or in the case of the French Union or the British Commonwealth, within the Union or Commonwealth); in many cases the majority of the shareholders and/or directors must also be nationals of the country where the ships are to be registered.

The advantage enjoyed by owners of flags of convenience ships in being able to accumulate capital and to obtain large and often extended credits has already led, as post-war statistics show, to a faster growth of fleets under flags of convenience than of other fleets. This, in turn, has meant a diminishing degree of influence on world shipping on the part of the maritime countries with their generally accepted standards of effective maritime jurisdiction and authority.

Warning to Traders

At first sight, as the report points out, it may appear to importers, exporters and other traders that the increasing number of ships operated under flags of convenience is bound to be entirely to their advantage. The cost of international maritime transport is, however, determined not primarily by the flag distribution of world tonnage, but by the laws of supply and demand in the international freight market.

There is no indication that deliveries from shipbuilding yards and therefore the total supply of new buildings, would have been less without the orders placed by the owners operating under flags of convenience; indeed, it can be assumed that these orders have merely replaced orders which otherwise would have been placed by owners in the maritime countries. Furthermore, the operating costs, namely, bunkers, stores, equipment, wages, etc., are generally not cheaper for flags of convenience vessels. Finally it can certainly not be suggested that shipowners who have been able to expand under the tax-free shelter of the flags of convenience countries can operate ships more efficiently than those owners who continue to run their vessels under their real national flags.

One of the dangers of slackening demand for ships and consequent lower freight rates is the temptation it brings to economise on costs of operation by reducing the generally-accepted stan-

Ships under "Flags of Convenience"—continued

dards of safety and manning, or by lowering wages and conditions of employment. Such temptation is effectively controlled, or at least countered, sometimes by domestic agreements or legislation and sometimes by international conventions, but the extent to which this control exists or can be exercised is less in the case of flags of convenience countries than in the maritime countries. This less effective control and the absence of industrial machinery for collective bargaining in these countries might result in a cutting of freight rates by owners of "convenience" ships through a reduction of standards of safety or employment; in the long run this would not really be to the advantage of traders.

Social Aspects

In the maritime countries all matters connected with crews are regulated by national legislation, administrative regulations or collective agreements. This is far from being the case in the flags of convenience countries. As to the general social aspects, the International Labour Office, which is obviously the proper international body through which a solution of the social side of the problem should be sought, has prepared recommendations on this subject. Attention is drawn to two specific points. The first is that maritime countries, sometimes at great expense to the public budget, maintain high standards of instruction and training for officers and crews; the flags of convenience countries do not trouble themselves in this regard, as those owners take practically all their officers and seamen from the nationals of the maritime countries. This has led to a shortage of personnel in their own fleets.

The second point is that time of service is generally recognised as enabling a seaman to qualify for his national certificate of competence. The flags of convenience countries do not appear to possess such a system, nor to have any administrative machinery enabling them to issue official certificates showing the period served by foreign sailors on their vessels. In fact it is due to the measures taken by the maritime countries in these fields that the shipowners of those countries have heavy financial burdens to bear. Contributions to social expenditure, education of sailors, administrative expenses in connection with the control of safety at sea, etc., form a considerable item in the budgets of the shipowners of the maritime countries.

Enforcement of Law

The conditions in the maritime countries which ensure control of the ships which fly their flags and enable these countries to give full effect to the requirements of the various international shipping conventions are lacking in the flags of convenience countries. It is true that Panama, Liberia, Honduras and Costa Rica are all parties to the Loadline Convention of 1930 and the two former are also parties to the Safety of Life at Sea Convention and the Collision Regulations of 1948, but these countries are apparently unable to take any effective steps to enforce the requirements.

Most maritime states have a complete body of maritime law, both civil and penal with regard, inter alia, to carriage of goods by sea, bills of lading, limitation of liability, salvage, collisions and so on, as well as experienced courts to deal with this law.

Specific attention is drawn to the recent report of the International Law Commission which says that "for purposes of recognition of the national character of the ship by other states there must exist a "genuine link" between the state and the ship." Whatever form the genuine link should take in practice, it appears that from the point of view of international law it presupposes the exercise of national jurisdiction and control over national shipping.

The International Law Commission has already attempted to draw up in legal terms a definition of the minimum national element in the ownership of a ship, but found that so many systems were possible that the attempt was abandoned. The Commission commented that the link must be no mere administrative formality and that the state must be able to exercise jurisdiction over the ships and control in matters concerning safety which must be effective. The flag state should be in a position both under its own domestic law and under international law to exercise, and should in practice exercise, effective jurisdiction over ships flying its flag, and the right to fly its flag should be limited and regulated accordingly by its domestic law.

It may be that, as with the Commission's attempt to define ownership, it will not be found possible to resolve the differences in practice between states so as to evolve a common formula which all states could agree to enforce, but it is considered that this in no way diminishes the validity of the principle that the flag state should exercise full jurisdiction and control over the ships flying its flag.

A "Body of Law"

In addition, it is suggested that the flag state should have a body of law covering such commercial maritime subjects as the rules for the carriage of goods by sea, limitation of liability, bills of lading, etc., to the extent required by its maritime development and the activities of ships under its flag. The extent to which shipowners, charterers, etc., have recourse to the courts of the flag state of the defendant probably reflects to a greater degree than most aspects of shipping the true relationship between the ship and her flag.

Where a shipping company has no assets in the flag state, and the owners, directors and managers are not nationals, it is useless to have recourse to the courts in those countries, as they cannot enforce their decisions. It is significant that even the owners of vessels under flags of convenience prefer to have their disputes settled in the courts of the maritime countries.

If, therefore, the exercise of effective jurisdiction and control is to be taken as the condition for the recognition of nationality, it also clearly requires the existence in a state of a body of legislation, administrative services and a technical system at home and overseas capable of imposing that legislation on its ships. At present only the necessary standards of safety are ensured simply as a result of the ability of the maritime states to control ships of all nationalities entering their ports.

Although the requirement that there must be a genuine link between the ship and the state whose flag she flies is sound, it could only be effective against cases where that genuine link does not exist if the term can be clearly defined. The International Law Commission consider that the genuine link must exist for the purposes of recognition by other states and presumably it would be possible, in the eyes of international lawyers, for states to refuse to recognise the nationality of any ship whose country of flag was not genuinely linked to the ship through proper jurisdiction and control.

If pursued to its logical conclusion, one effect of non-recognition would be to prevent these ships from sailing the seas at all, for most states have a rule that ships must declare their nationality before they are allowed port clearance. In the absence of international standards and agreements which would establish the validity and correctness of such non-recognition and would ensure that it would be effective, it would, of course, be useless to consider it.

Shipowners' Views

So much for the O.E.E.C. study. The views of United Kingdom shipowners were expressed at the annual meeting of the Chamber of Shipping, when a resolution was passed recording its profound concern at the serious implications for British shipping of the rapid expansion of tonnage trading under flag of convenience countries, much of which operates under virtually tax-free conditions without the obligations and responsibilities of the shipping of the traditional maritime powers; and stressing the urgency of establishing conditions under which British shipping can compete on terms of parity with ships flying these flags of convenience.

Mr. C. F. B. Arthur, the chairman of the Deep Sea Tramp Section, in moving the resolution, said that whatever the reasons for the growth or the motives which had inspired it, the fact remained that they were faced with a phenomenon quite unprecedented in the history of the mercantile marine. A small group of countries with no maritime traditions or aspirations had found its share of the active world fleet increased from 1.5 per cent. to over 15 per cent. within a period of twelve years. In the space of nine years Liberia alone had been transformed from a 1-tanker state to the country with the second largest tanker-fleet in the world.

The tax liability of ships registered under flags of convenience

Ships under "Flags of Convenience"—continued

represented less than 9d. per net ton; as against this, taxation on the earnings of United Kingdom shipping represented an average of something over 2s. for every ton of cargo carried. If they were to seek conditions under which they could compete on terms of parity, an increase of taxation for the flag-of-convenience ships or a reduction for British, or, perhaps a mixture of both, suggested itself. If, however, it should prove impossible to find a solution in this field, he would urge the industry to face the problem free of inhibitions. Traditional policies had served them well in the past, but they must not let observance of them blind them to a development which threatened their very existence as the leading maritime power in the world.

Mr. R. M. Thwaites, seconding the resolution, said that passenger ships had not escaped the competition of this favoured fleet. There were a number of such ships trading which wore these flags. They moved from trade to trade, skimming any cream they could find. A century ago these ships would not have been able to sail the seas without the countries of registry having adequate naval forces to protect them.

Mr. G. Hutchinson, supporting the resolution, said that the immense growth of tonnage under this gentlemanly label of "flags of convenience" was a refined form of sabotage. Ships flying these flags were the modern freebooters of the world's sea routes.

Mr. R. D. Ropner, the newly-elected president, said in his presidential address that he regarded the flag of convenience as the British shipowner's Public Enemy No. 1. In ten years' time Liberia could have over 30 m. gross tons of shipping flying her flag and in that event would be the biggest "maritime" country in the world. He admitted that this forecast was based on estimates made while the market was good. The assumption was that the rate of increase in world tonnage and the increased proportion of world tonnage under the Liberian flag would both continue their recent trends. He urged that the prodigious growth of the tonnage under flags of convenience required the whole question of taxation, so far as United Kingdom shipowners were concerned, to be brought under complete review.

A solution must be found and be found soon. In ten years' time it might be too late.

New Terminal at Seven Islands, Quebec

Description of Bulk Ore Handling Facilities

Owing to the severe weather conditions in north Canada, it is only possible to mine ore from the various deposits near Knob Lake for about five and a half months of the year. The ore is shipped, however, from the Seven Islands Terminal (situated some 360 miles south of Knob Lake) which is open to navigation for about eight months each year. It is therefore necessary to stock-pile large quantities of ore at Seven Islands for later shipment during the extra navigation period.

The Iron Ore Company of Canada, who own the Seven Islands ore handling installation, have constructed a dock 1,600-ft. in length with a dredged depth of 37-ft. alongside at low mean tide to accommodate the ore carriers. 800-ft. of this berthing space is for loading and the remaining 800-ft. for mooring accommodation. The Federal Government has also constructed a further 600-ft. at the north end, dredged to a depth alongside of 27-ft., the whole making one continuous dock (see Fig. 1).

The ore mined at Knob Lake is of different types and varies in its characteristics. It may be lump ore, like coarse sand, like soft mud, or a mixture of all three; it weighs between 135 and 150 lb. per cubic ft. After it has been crushed to 5-in. at the mines, the ore is transported in trains comprising some 115 trucks, each of which has a capacity of 90 long tons. An average of seven trains a day make the trip from the mines, finishing their journey in the classification yard of the terminal, which is located on the flat, sandy, coastal plain two or three miles from Seven Islands. This means that a total of over 70,000 tons of ore arrives at the terminal each working day.

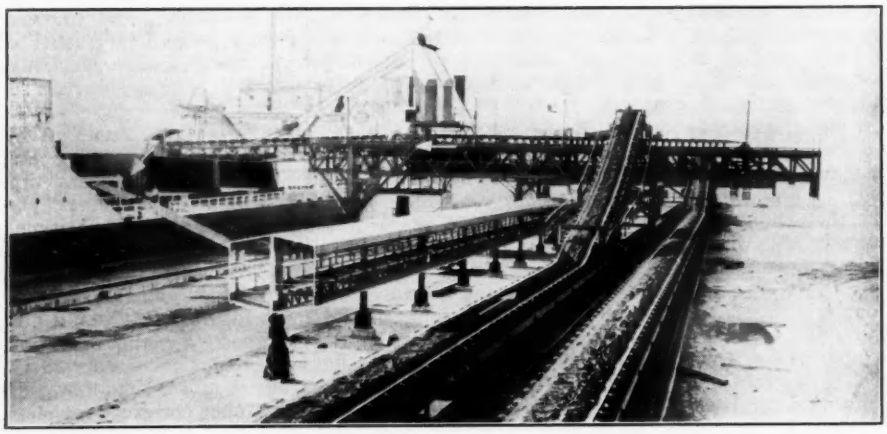
The loaded trucks are sampled at the mines and the ore analysis communicated to Seven Islands before the train arrives. They are then passed through the rotary truck dumper at the terminal to obtain an average cargo analysis. At the classification yard, the ore handling facilities have a capacity of 8,000 long tons of ore per hour loading into ships, or of 3,000 long tons per hour loading to the storage piles.

The ore graders arrange for the delivery of trucks to the various tracks of the classification yard according to the grade of ore. Diesel electric shunting locomotives then push the trucks to the inert retarder at the foot of the barney slope, under the instructions of the ore grading staff. The trucks in the inert retarder are next pushed up the 11 per cent. incline 220-ft. to the tandem rotary truck dumper by the barney mule, which is a heavy chassis on wheels pulled up by two steel wire ropes and running back to its original position by one tail rope. This mule operates on two sets of tracks so arranged that it uses the outer when pushing trucks, and the inner when returning to its starting point. The mule returns to rest at the bottom of the incline by travelling on the inner track underneath the next two trucks waiting in the inert retarder, and the rapid rise of these inner trucks enables the mule to engage the rear coupler of the cars to be pushed up the incline. This operation is under the control of the operator in the dumper house and is protected by various safety devices.

When the pusher locomotives deliver the trucks to the retarder, they leave them on a section of insulated track and themselves must actuate a limit switch to ensure this. Unless the trucks are entirely on the insulated track, the 5-volt current which it carries is shorted; also, on its return journey the mule must actuate a limit switch at the end of its travel. These precautions ensure that the mule is in its correct position and that the trucks are ready to be engaged successfully at the coupler by the mule at the beginning of its cycle. Should a short occur, the equipment can-

General view of Seven Islands storage and loading facilities. Marshalling yard in right background.

New Terminal at Seven Islands, Quebec—continued



Twin 60-in. belts carrying ore from blending bins to travelling dock bridges. Shuttle conveyors with pivoting boom belts on bridges move into position for discharge to ships' holds.

not be moved until the fault has been rectified.

The barney haulage operation is completely automatic, being run by a nut limit switch which has a zero speed switch on it to cut off the power in the event of any failure. The barney haulage pushes the trucks up the incline at 600-ft. a minute, engaging them with the empty ones already in the dumper at 200-ft. per minute and then accelerating to 300-ft. per minute before coming to a halt at the end of its travel. It is then returned to its original position, forty-five complete cycles being made in an hour.

The Barney Hoist

The barney hoist consists of a single, parallel-face welded drum about 7-ft. in diameter by 9-ft. 9½-in. long, grooved for the three cables mentioned. It is driven by two 350 h.p. D.C. motors through gear flex couplings and herringbone pinions to a ring gear mounted on the hoist drum. The large gear dips in oil and oil is pumped to the pinions. The hoist is mounted on anti-friction bearings and the motors are provided with solenoid brakes on their double-ended shafts. Power is supplied through a 700 h.p. motor generator set.

The hoist building is located below the barney slope, so that the wire ropes are in line with the drum. This building is divided into two parts and the one housing the electrical apparatus is pressurised to protect the equipment from dust.

The dumper operator stops the two full trucks delivered by the barney mule by using two air operated retarders, one in each half of the tandem dumper. The arrival of the two full ore trucks pushes the two empty trucks out of the dumper and these return by gravity to the yard. Should the full trucks not have been stopped in quite the correct position in the dumper, they are moved along by lever or pulled in either direction by two 10 h.p. vertical spindle pullers provided for the purpose.

The operator rotates the dumper towards him through about 180° and so can see the inside of the trucks. The rotation automatically actuates by counter weights the clamps which hold the trucks to the rails. These clamps have been designed so that vibrators can be mounted on them to assist in clean dumping of the ore should this be necessary. One or two cars can be dumped at a time.

The dumper house, which is situated about 500-ft. from the shore, provides duplicate facilities; beside the tandem dumper with its two units coupled together, there are two separate 38° grizzlys, two crushers, two hoppers, two feeders and two reversible belts below the feeders. The basement floor of the building is about 30-ft. below ground water and 20-ft. below mean low tide.

There is a possibility that ore will freeze in the trucks during the 16-hour journey from Knob Lake or in the storage piles and, in order to ensure that frozen lumps will not enter the hoppers in over-sized dimensions, the grizzlys, which are 28-ft. long by 26-ft. wide measured on the slope, discharge such lumps for crushing to the two 36 by 60-in. reversible crushers, which can be set to discharge the size required. It is possible to isolate the crushers and crusher hoppers by hinged doors at the foot of the main grizzlys.

All ore passing through the main grizzlys, i.e., 5-in. and under, falls into two concrete hoppers holding 360 long tons each. Valley angles are at least 60°, and each hopper is emptied by a four-speed, 72-in., manganese steel pan feeder which discharges ore at 1,000, 2,000, 3,000 or 4,000 tons per hour onto the 72-in. reversible belt below it. The maximum depth of ore stream is 4-ft. and the maximum delivery rate to storage piles is 3,000 tons per hour. When running south these belts feed the shiploading system and when running north they feed the storage system, their direction being selected by the dumper operator.

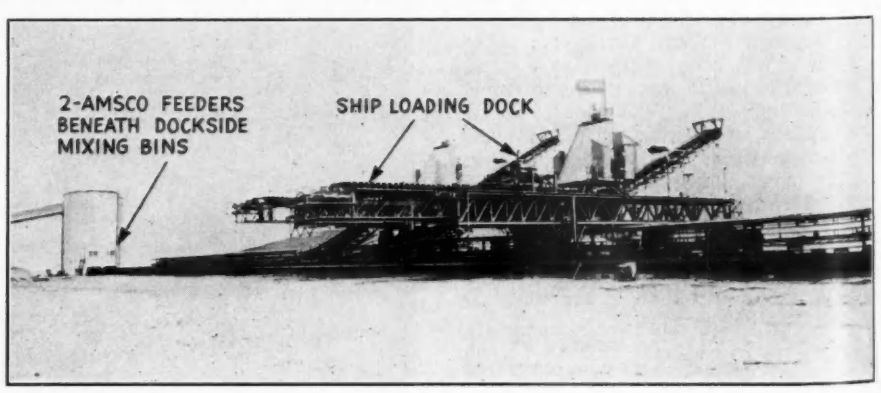
Ship-Loading of Ore

Ore for the ships leaves the dumper house on the 60-in. belt conveyors, which are 154-ft. in length and run at 600-ft. a minute. All this equipment is on the same floor level as the lowest floor of the dumper house and is housed in a waterproofed concrete tunnel about 24-ft. wide and in the drive house, which has a high roof over the lifting apparatus and an exit to the surface.

At this drive house, ore is transferred to two 60-in. conveyors inclined at 12°, which discharge into two 1,000 ton concrete mixing bins 38-ft. 8-in. outside diameter, built as a monolithic structure on the loading dock. The top floor of these bins is 60-ft. above the dock surface. The conveyors are driven on the return side about halfway down, using dual drives of 500 h.p. and 175 h.p. respectively, totally enclosed squirrel cage motors. The take up is by gravity. Protection is provided to the belts by an electric eye in each bin which warns the operator when the ore reaches a predetermined height, so that he may either stop dumping or stop the feeders below the dumper house hoppers and so arrest the feed to the bins.

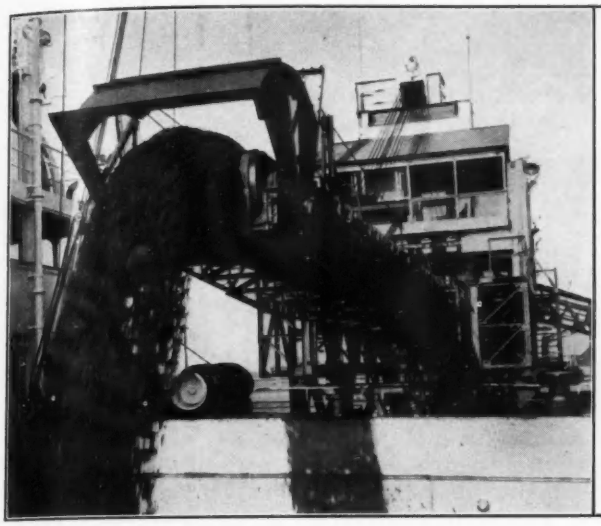
Ore is withdrawn from the mixing bins by two 72-in. variable speed manganese steel pan feeders which discharge to two 60-in. belt conveyors traversing the length of the 800-ft. loading dock (Fig. 2). These feed two shiploaders through trippers, the drives being at the head ends of the conveyors.

The shiploaders are mounted on rails 70-ft. apart and consist of a truss of U-shaped cross-section. Inside this truss is another which carries the shuttle belt,



Landside view of travelling bridges, showing boom shuttle conveyors in raised position to clear superstructure of ships.

New Terminal at Seven Islands, Quebec—continued



Discharge of ore into ship's hold from 60-in. boom conveyor at rate of 4,000 long tons per hour.

Stacker delivering ore to either side of 2,200-ft. horizontal run of stock pile. Conveyors are interlocked but can be run manually.

which is hinged at the centre and can be advanced and retracted and the half near to the ship raised about 60° above or lowered 15° below the horizontal. The shiploaders can travel along the dock at 80-ft. per minute while loading and can operate at 48-ft. centres (see Fig. 3). During loading, the shuttle belt on its truss can be moved backward and forward at 50-ft. per minute. The capacity of each shiploader (see Fig. 4) is 4,000 long tons per hour and limit switches govern their total travel and proximity to each other. Spring stops are provided at the ends of their travel. The size of ships which may be loaded ranges from 2,000 to 27,000 tons. Power is supplied to the shiploaders at 550 volts from the sub-station in the drive house through aluminium conductor rails and is picked up by sliding shoes. A somewhat similar arrangement is used to provide power to the shuttle belt and boom elevating apparatus.

The bridge is kept in proper alignment on the rails by the use of two electrical devices mounted on the landward leg of the shiploaders about 15-ft. apart. These envelop the head of the rail but are clear of it. Any misalignment of the bridge causes a variation in this clearance, with a consequent variation in inductance, which is used to actuate a selsyn control to slow or speed up the drive motors on either rail supporting the shiploader. Thus the end ahead is slowed down and the lagging end is speeded up. With this equipment, the shiploader operator can traverse in any of four directions in the horizontal plane besides moving the boom up and down during loading. He can start, stop or slow-down the feed, as he has control of the feeders below the mixing bins, and he can start and stop his conveyors in accordance with instructions given from the ship or elsewhere by radio. The capacity of each shiploader is increased 12% or 500 tons an hour when moving the bridge towards the load while operating.

Ore Storage Facilities

Two parallel 48-in. wide belts carry the ore from the dumper house to the storage area where they feed the ore to a double-arm self-propelled, rail mounted stacker (Fig. 5). Each belt has a capacity of 3,000 tons an hour. Each stacker can build two piles of ore 2,200-ft. long and 87-ft. in height and containing 500,000 tons when full. There is a total storage capacity for 2,000,000 tons of ore. The stacker may be traversed in either direction while discharging and the high-torque high-slip propelling motors may be plugged or reversed to provide braking action. Dual controls allow the operator to face the direction in which he is moving.

Ore is reclaimed from the storage piles by electric shovels with 7 cu. yd. dippers. These place the ore in the ore trucks which are again passed through the classification yard and so enter the system a second time.

All conveyor belts can be started and stopped under full load and are interlocked so that a load cannot be placed on a belt unless it is running at full speed, centrifugal switches being used. Warning of high winds is given to the shiploader and stacker operators by two anemometers which give warning of winds of 35 miles an hour or more. Power is supplied to the main sub-station for this area at 44,000 volts and stepped down to 4,160 volts in three 2,000 K.V.A. single phase transformers. One spare transformer is provided.

The design and construction of the docks and ore handling facilities were the responsibility of the C.D. Howe Company, Ltd., of Montreal, and the conveyor system was installed by the Stephens-Adamson Manufacturing Co. of Aurora, Illinois.

Chamber of Shipping's Annual Report

Port Charges, Turn-Round and Other Dock Matters

(By a Special Correspondent)

Several important matters of interest to dock authorities are dealt with in the annual report of the Chamber of Shipping of the United Kingdom. On the subject of turn-round of shipping in this country, it is remarked that the welcome freedom from dock labour stoppages here during 1956 fortunately continued, with certain exceptions, in 1957. The available statistical information suggests that the turn-round of shipping in United Kingdom ports has shown a further slight improvement. This is borne out by the relatively few complaints brought to the Chamber's notice during the year.

The absence of any prolonged dock labour stoppages undoubtedly contributed to the better position, although there must be taken into account the reduction in the volume of imports of bulk commodities such as grain and coal. In addition, most of the principal port authorities have continued their programmes of development and modernisation, including increased mechanisation and better cranage facilities, all of which help in speeding cargo through the ports. Unfortunately, it is added, the improved position in the country was not matched everywhere abroad, where in some ports turn-round remained deplorable.

On port charges it is stated that a new draft charges scheme, covering the port's under the jurisdiction of the British Transport Commission, has been submitted to the Transport Tribunal for confirmation. It provides for the maintenance of the existing pattern of dues on ships, merchandise and passengers, with the

Chamber of Shipping's Annual Report—continued

addition of a 25 per cent. margin above the existing maxima. For numerous ancillary services, some of which are at present subject to statutory schedules of charges, the scheme proposed "reasonable charges." The principles inherent in this new scheme are consistent with current practice at the principal non-Commission ports.

The Commission contemplate the promotion of further schemes for individual ports or trades as and when it becomes necessary from a financial standpoint. It is their intention that the new scheme, if confirmed by the Tribunal, shall continue to operate at all their ports unless and until an individual port scheme is promoted.

Increased Charges

Rising costs have resulted, the report goes on, in a further round of increased port charges. The British Transport Commission, with the authority of the Minister of Transport, introduced a five per cent. increase in charges at their ports with effect from 1st August. At Blyth, Bristol, Clyde, Leith, Liverpool, London, Manchester, Preston and Southampton it became necessary to increase charges within the existing statutory maxima by varying percentages. In all these cases it was found that the increases proposed were necessary to meet rising costs of operation, or for the purpose of the raising of capital required for port improvements.

Under the established procedure for the revision of rates, applications were made by the authorities concerned for Orders authorising increased maximum charges at Dundee, Inverness, Penryn, River Cart, Tees and Tyne. An examination of the financial position of these undertakings showed that the proposals were justified and no objection was raised. A similar application by the Corporation of the City of Exeter was the subject of a local inquiry, at which the Chamber was represented. An assurance was obtained that the increases proposed would only be applied in consultation with users and after careful consideration of the competitive position not only of the port but also of coastal shipping in relation to road and rail. After obtaining a similar assurance, the Minister of Transport authorised the increases.

It is one of the tasks of the Chamber, acting through the Traders' Dock and Harbour Co-ordinating Committee, to keep a watch on adjustments of charges at the ports. This has been made easier because of the willing co-operation of most of the principal authorities in taking users into consultation before proceeding with their proposals.

Pilots' Earnings

The principal recommendations of the report of Sir Robert Letch's Committee on the earnings of pilots constitute a scheme for the determination and stabilisation of the earnings of the great majority of licensed pilots. In essence, the scheme provides that earnings at the ports it covers shall be at the recommended levels and that these shall normally be increased or decreased in accordance with general increases or decreases in the National Maritime Board scale of pay for navigating officers. It is a basic condition that the proper number of pilots is licensed for a district. Provision is also made for short term variations in earnings due to temporary fluctuation in traffic. Any party to the report can request a general review after 31st December, 1959. The recommendations, says the Chamber's report, should do much to obviate the need for Ministry of Transport inquiries into the earnings of pilots at individual ports, so prominent a feature of pilotage administration in the past. The report has been accepted by virtually all the pilotage authorities responsible for the districts concerned and most of the pilots affected are now receiving earnings at the recommended level.

Wreck Removal Claims

Reference is made to the diplomatic conference at Brussels, at which the Government delegation was led by Sir Gonne Pilcher, and the convention on limitation of liability adopted in its final form there. The convention extends the right of limitation to wreck removal claims made by dock and harbour authorities, a right which in most United Kingdom ports does not exist. This provision was made the subject of a reservation by a number of Governments at Brussels, including H.M. Government.

Negotiations have been going on for some time in this country with the Dock and Harbour Authorities' Association aimed at the withdrawal of its opposition to the application of limitation of liability to such claims, but these had not been included at the time of the Brussels conference and now have to be resumed. If agreement is reached, H.M. Government would be able to withdraw its reservation.

The measure of international agreement secured at Brussels, it is stated, is gratifying and it is to be hoped that legislation will shortly be adopted by Parliament to enable H.M. Government to ratify the convention without delay.

Industrial Re-Rating

Having completed its review of local government finance, the Government introduced a comprehensive Bill which, among other things, carries out its earlier declared intention of re-rating industrial and freight hereditaments from 25 per cent. of the net annual value, as at present, to 50 per cent. The effect of such a proposal may mean that many port authorities, in order to meet their increased liabilities to local rates, will find it necessary to consider increasing their charges. The Chamber is in consultation with the Dock and Harbour Authorities' Association on the matter.

Milford Haven, Clyde and Blyth

Before the Bill to set up a conservancy authority for Milford Haven was introduced, the proposed constitution of the new authority and its powers and duties were considered by the special committee set up by the Minister of Transport. The constitution originally proposed for the authority would, in the view of the Chamber, have given an undue preponderance of membership to non-trading interests, as against the commercial users of the Haven. The Bill as introduced, however, provided for a more acceptable constitution and, in its progress through Parliament, the industry is likely to be only concerned with matters of detail.

The Order promoted by the Clyde Navigation Trust included provisions for increasing the trustees' maximum rates and charges and for conferring on the trustees what, in effect, could amount to monopoly powers in the handling of bulk mineral cargoes. It was necessary for the Chamber and the local port employers to petition against the Order. As a result, the trustees agreed to an amendment which disposed of the Chamber's objection to the proposals with regard to increased charges and, at the inquiry into the Order, the provisions relating to the handling of mineral cargoes were deleted.

The Blyth Harbour Commissioners proposed by their Bill to increase their maximum charging powers by 50 per cent. Although the Chamber normally regards a margin of 25 per cent. between actual and maximum charges as adequate, in this case it was apparent that the Commissioners would require to utilise some of the proposed margin within the next few years to service borrowings for the replacement of plant and to build up their reserve fund.

The remainder would be required to counteract the reduction in the volume of coal at present shipped outward through the port, much of which will be diverted to the new power station to be constructed near Blyth. The Chamber did not oppose the Bill, but it was made clear that it had refrained from doing so because of the special circumstances and that such action was not to be regarded as a precedent.

Workington Harbour

The United Steel Company, Ltd., which provides over 90 per cent. of the traffic in the port of Workington, promoted a Bill to transfer the harbour from the Workington Harbour and Dock Board to the company. The Bill contained extensive powers to increase maximum charges for the use of the harbour. The company proposed to exercise these powers to try to put the undertaking on a self-supporting basis.

The Chamber pointed out to the promoters the need to keep to a minimum any further financial burdens on the coasting trade and obtained an assurance from the promoters that they would consult the Chamber with regard to any proposals affecting the actual rates to be levied on vessels.

Modern Dry Docks: Design, Construction and Equipment

VI Dock Pumping Machinery

By G. A. WAUCHOPE, M.I.Mech.E., A.M.I.E.E., M.I.W.E., Mem.A.S.M.E.

The Main Pumps and Their Duties

THE purpose of the main pumps is to de-water the dock. This may be done when there is a ship in the dock or where it is necessary to empty it to adjust the position and number of blocks. Where the water carries a fair amount of silt in suspension it is sometimes the practice to close the dock gates and de-water the dock when it is not in use.

At the time that the dock gates are closed, the level of water in the dock is the same as outside so that when the pumps are first started up, the head which they have to generate is only the friction and other hydraulic losses in the culverts, pipes and valves, etc. As the water level in the dock falls, so the height through which the water must be lifted increases. This is usually called the static head. The total head against which the pumps have to operate is the combination of the static head and the friction and other losses. The pumps discharge at their highest rate when the total head is low and although the friction losses are fairly high when pumping first commences, the total head increases and the quantity discharged by the pumps gradually decreases as the dock empties.

Docks which have a number of altars are much wider at the top than at the bottom and consequently the rate of de-watering each foot of dock is approximately the same.

Fig. 1 shows the typical characteristic curves of a modern centrifugal dry dock de-watering pump. The upper "Head-Discharge" curve indicates how the rate of discharge varies with the total head which the pump has to generate. The discharge corresponding to the various heights through which the water has to be lifted, the "Static Head," is shown on the lower curve and the difference is the loss due to friction and other causes in the culverts, pipes, valves, etc. When the dock is full and the pump just started, the "Static Head" is zero and the discharge rate at its maximum Q_1, but as the dock empties so the "Static Head" increases until it reaches its maximum when the dock is empty and the discharge rate has fallen to Q_2. It will be noticed that the pump efficiency rises to a maximum when the discharge rate is Q_m and then falls slightly until the dock is empty. It will be seen that with this type of pump there is only a small variation in the horsepower absorbed during the de-watering operation.

Care must be taken to select the correct design of pump so that the minimum amount of power is used and the first cost of the equipment is kept as low as possible. Fairly complicated calculations have to be made in each case, some details of which have been given elsewhere by the author and Humphreys[1].

In some ports there is a considerable tidal variation, this must be taken into account when determining the most suitable hydraulic design of pumps and the size of the motors. It is a generally accepted practice to arrange for the crowns of the discharge culverts to be situated well below the lowest tide level.

It will be appreciated that if the de-watering is started at high tide, the level outside the dock will fall quite appreciably during the pumping operation, consequently the maximum static head against which the pumps must operate when the dock is nearly empty is reduced by the fall in tide level during the time of de-watering.

While this fact may be taken into consideration when designing the pumps, it is important to note that they should be capable of discharging a reasonably large quantity from a practically empty dock against high tide level because circumstances might arise in which pumping has been commenced at a relatively low tide and has to be concluded at high tide. It is also usual to arrange for the main pumps to be capable of lowering the level in the suction culverts to several feet below the bottom of the dock.

It is often found convenient to make arrangements to control the rate of de-watering so that when desired, it can be slowed up, this is usually more convenient than repeatedly starting and stopping when the ship is being washed down by men working in floats. While there is still some depth of water in the dock, it flows freely to the suction grating but as the level

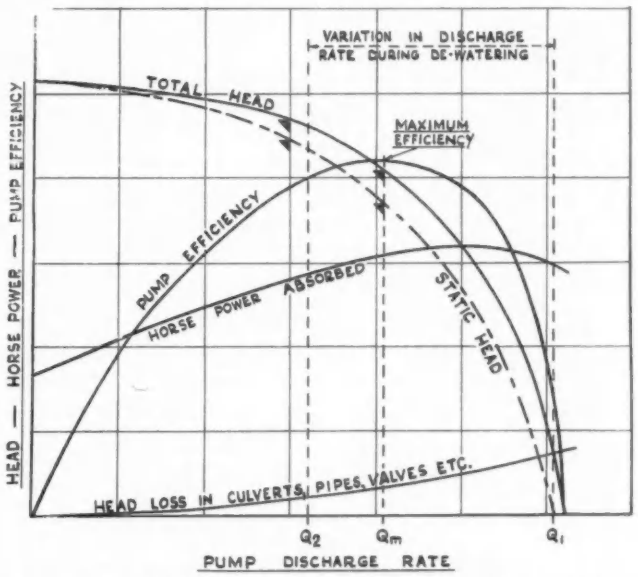


Fig. 1. Characteristic curve of a typical modern centrifugal dry dock de-watering pump running at a constant speed.

approaches the bottom of the dock, the hydraulic gradient from one end to the other increases rapidly and unless the main discharge is slowed up, there is a possibility of one end of the dock being practically dry while there is an appreciable amount of water left at the other end.

The pumping rate may be controlled by closing the discharge valves on the pumps or if there are two or three pumps operating together, to stop one or more to obtain the desired effect.

Another method of reducing the rate of de-watering is by partially opening the dock filling valve. This may have the advantage in some cases that the rate at which the level of water in the dock is reduced is controlled directly from the dock side.

In some ports where there is a large tidal variation, one of the main pumps is arranged in such a manner that it can be used to impound water by drawing from outside and raising the level in the dock. This is accomplished by the arrangement of the suction and discharge culverts and valves. A notable example of this is King George V Dock at Southampton.

Sometimes a set of two or three pumps are used for de-watering only one dry dock. On the other hand, there are very many examples where a central pumping station is used for

Modern Dry Docks—continued

de-watering a number of different docks and it is usually found that they are of different size not only in capacity, but also in depth. It is obvious that the pumps must be designed to de-water the largest and deepest docks in the required time, but if there is a wide difference in the capacities of the docks, care must be taken that there is adequate control of the pumping, so that the time of emptying the smaller docks is not inconveniently short.

When the pumps are required to de-water only one dock and there are no intermediate caisson stops and consequently only one suction grating, the arrangement of the culverts is very simple. When, however, there are two or even three suction gratings, any one or more of which can be used simultaneously as when the dock is divided into separate sections, the arrangement of the culverts becomes more complicated. A number of large penstocks or sluice valves are involved and great danger may arise from the incorrect sequence of operation. If there are two or three main pumps each having its own suction and discharge sluice valve and which have to be primed under certain docking conditions, it is generally considered essential to use a central control system. Some details of this equipment will be given later but it should be noted that the system of operation is usually as follows:—

The starting and stopping of the pumps and the control of the pumping rate is effected from the central control desk by an operator who receives his instructions from the official responsible for the docking, either by signals or by an engine-room type telegraph. The filling valves are controlled on the dock side by independent switches and are not operated from the control desk.

Type of Pump Drive

Steam engines were originally used to drive the dry dock pumps but most of them have now been replaced by electric motors. In some cases the steam engines have been removed and electric motors installed in their place, but usually this is not an economical arrangement as the speed of the steam driven centrifugal pump is much lower than would be the case if they had been designed to be driven by electric motors. Consequently the new motors are very large and costly.

Another difficulty arises from the fact that the space taken up by the steam engine is much smaller than that required by the motor and therefore it is often difficult or impossible to make this conversion.

In at least two cases the problem has been solved by the complete removal of the original steam driven pump and the installation of a high speed mixed-flow or axial-flow pump in the original vertical suction pipe. The drive is then of course by a vertical spindle electric motor.

In a few cases the main pumps are driven by diesel engines but by far the most usual method is to use electric motors. The reason for this is that the running hours of the main pumps is relatively short and the capital cost of installing large diesel engines is very high compared with the cost of the electrical equipment and the saving which may be achieved by the lower running costs of diesel engines as compared to electric motors is usually insignificant in comparison.

In many cases the power taken by the main pump is high compared with the other requirements in the dockyard.

Consequently where the method of charging for electricity involves a maximum demand charge, the cost of running the dock pumps forms an important part of the total cost of electrical power in the dockyard. It is frequently found that this charge is calculated on a K.V.A. basis and consequently it is in the interest of the dock authority to attempt to arrange that the power factor of the combined load from the whole if the dockyard, as well as from the pumps, is as near to unity as possible.

This is sometimes achieved by driving the pumps by synchronous induction motors which are designed to operate with a leading power factor so that compensation is made for the lagging power factor of the normal dock load. By this means the maximum demand of K.V.A. is reduced with consequent saving in pumping costs.

The cheapest and the most simple and reliable type of motor for driving the main pumps is the squirrel cage induction motor, the control gear consisting only of a stator switch. They have the disadvantage that the starting current may be fairly high, probably between six and eight times the full load current, but with specially designed rotors, this may be kept down to three or four times the full load current.

In many cases the high starting current may not be objectionable but where it is, it is not usual to employ current limiting devices such as auto-transformer or star-delta starters because of the large size of the machines but slip-ring induction motors are frequently used, the control gear for which must incorporate rotor resistances. These may be of the liquid type or have metallic resistors and automatic contactors.

The starting current with this type of motor can be limited where necessary, to just over full load current. Synchronous induction motors mentioned above, which are capable of adjusting the power factor of the system, usually have the equivalent of wound rotors involving starting resistances as in the case of slip-ring machines but in addition, have exciters which are separate D.C. generators, driven off the main motor shaft or in some cases by separate electric motors.

The starting torque required at switching-on has to be sufficient to overcome the stationary friction of the bearing and glands with an adequate surplus to give a reasonable rate of acceleration. It is usual to arrange for the switching on torque to be about 20% of the full load torque and should increase up to full load torque at full speed. In the larger sizes of motors, the machines may be wound for high tension electric supply but where they are relatively small, it is more economical to employ transformers and wind the motors for a low tension voltage of, say, 415 volts.

In some cases the stator winding of the motor is coupled solidly to the secondary winding of the transformer and the switching and overload protection is made in the high tension connections to the primary of the transformer. This arrangement, of course, involves a separate transformer for each motor.

The total volume of the pumping stations is usually fairly small and it must be borne in mind that arrangements have to be made for removing the heat which is generated by electrical and other losses in the motors. This may be as much as 8% or 10% of the total power of the machines.

One method of effecting this is to use motors of the enclosed ventilated type and to instal large ventilating fans which extract the air from the pumping station and discharge it at some convenient point.

An alternative to this is the use pipe ventilated motors. In such cases the air may be drawn in through one duct and discharged through another, the circulation being effected by fans in the motor carcass.

In other cases, electrically driven booster fans have been introduced into the motor ventilating ducts. In most cases the motors are provided with canopies or other protection against drips which may occur due to condensation in the interior of the pumping station.

In underground pumping stations, particularly when the pumps are not working, the temperature of the air may be kept cool by the large areas of pumps and piping in contact with cold water and when the ventilating system is started up, large volumes of warm air will be drawn in from the surface which may result in heavy condensation of moisture on vulnerable electrical parts. In consequence it is frequently found desirable to arrange for small electric heaters to be permanently installed in switchgear cubicles and similar positions. Protection of the electric motors is effected in a similar manner by providing heaters within the stator frames. These are interlocked so that they are switched-off when the motor is started up. In some large main motors, so as to economise in the size of the electric heaters, louvres have been fitted over the ventilation openings which are closed when the motor is not running.

In many countries the climatic conditions which cause this form of condensation are only present for a part of the year so, therefore, to avoid waste of energy in the heaters, a main switch for the heating circuit is provided to facilitate the control.

Modern Dry Docks—continued

The danger of flooding of the electrical machinery must be recognised. In most cases where the pumps and motors are of the horizontal spindle type, this hazard has to be faced but where vertical spindle sets are installed, it may be possible to mount all the electrical equipment at such a height in the pumping station that it is above high-tide level and consequently, even if the pumping station is completely flooded, it will not be damaged.

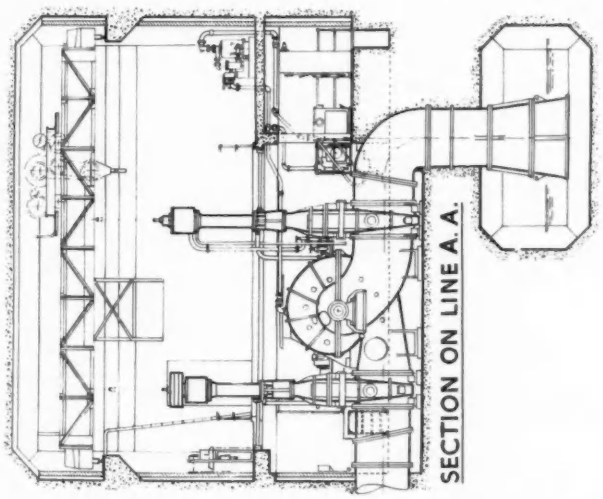
Types of Pumping Stations

The types of pumping stations fall more or less into three fairly distinct forms.

Type "A." This takes the form of a pumping station usually situated near the entrance to the dock and attached to it. It contains all the main pumps and the drainer pumps and other auxiliaries. It forms an appendage to the main dock structure and may require the deepest excavation in the whole scheme. The reason for this is that it is necessary for the crown of the suction culvert to be well below the bottom of the dock. Furthermore, the floor of the main pump suction sump must be at an even lower level. In the larger docks the excavation for the pumping station has to be very deep.

In the older docks the pumps were usually of the horizontal spindle type taking up a large floor area so that the volume of the excavation at the lowest level was also quite considerable. In large docks where for military reasons it is decided that heavy concrete protection above the pumps is necessary, horizontal spindle pumps are almost essential.

Fig. 2 shows the Sturrock Dock Pumping Station, Capetown, which is typical of this arrangement. This contains three main 54-in. horizontal centrifugal pumps driven by 1200 B.H.P. synchronous induction motors with Gwynne Glenfield self closing discharge and suction valves. Fig. 3 shows similar plant at Captain Cook Dock, Sydney.



In some of the more recent docks, the pumps have been of the vertical spindle type. By this means the floor space is considerably reduced with consequent saving in the cost of construction of the pumping station, and Fig. 4 shows the arrangement of the pumps at the new Dry Dock at Dublin.

Where it is found desirable to arrange the machinery so that the roof of the pumping station is level with the coping, the motors may be mounted directly on top of the pump casings as shown in Fig. 5 or provided with only a short length of intermediate shafting.

In this type of station access to the machinery must be made by providing removable coverings at coping level and as it is usually found impracticable to install a crane within the pumping station itself, it then becomes necessary to use a dock-side crane for dismantling and overhauling the pumping machinery.

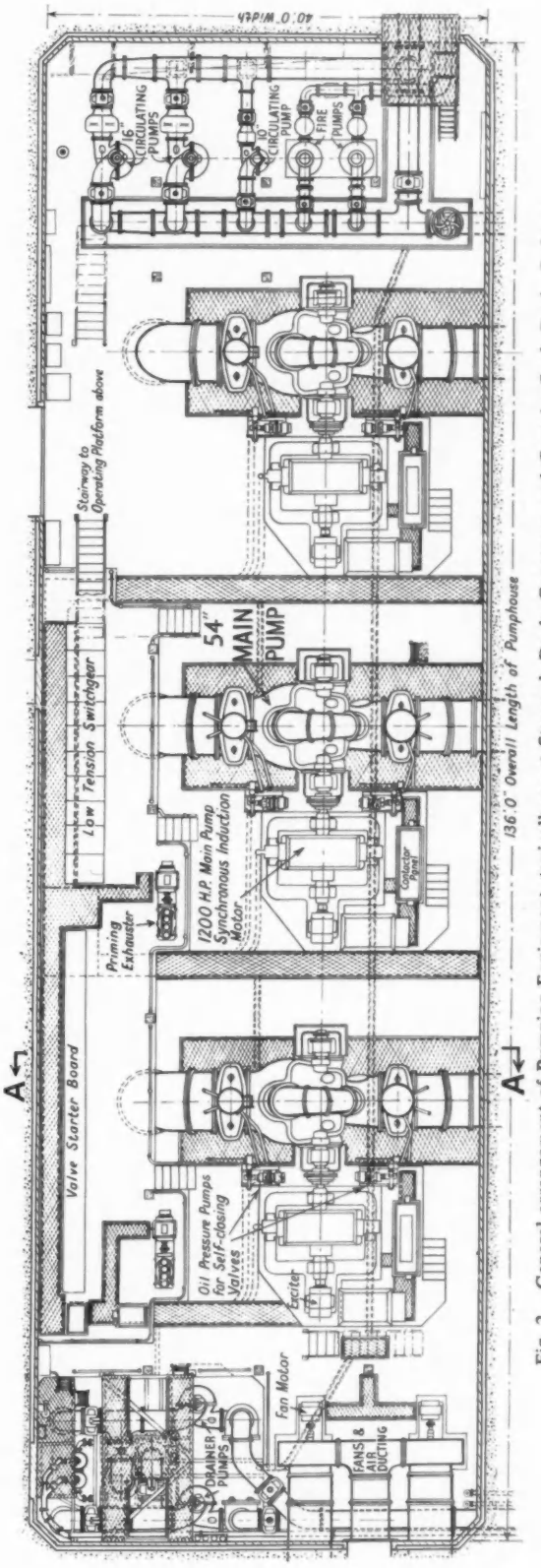
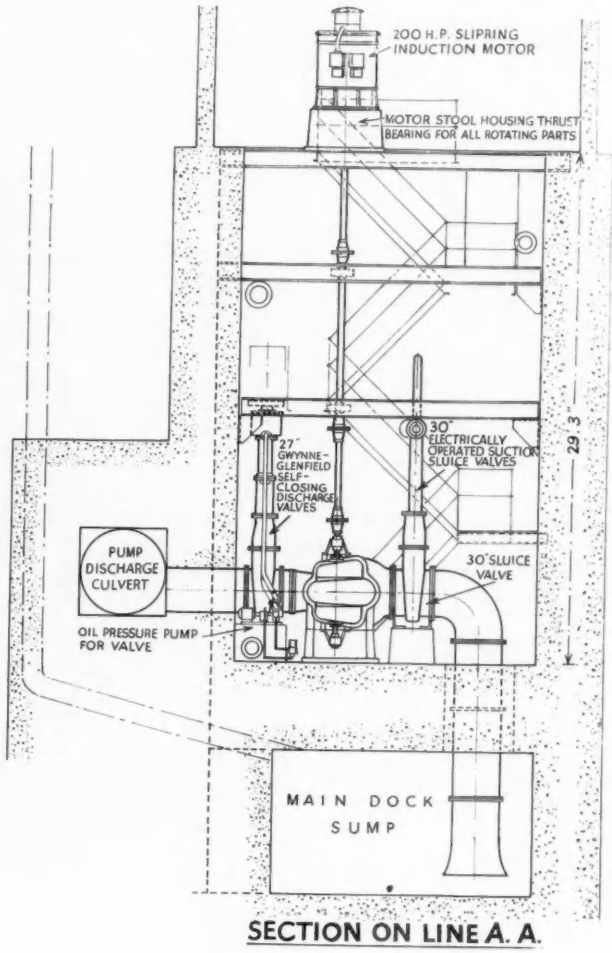


Fig. 2. General arrangement of Pumping Equipment, typically as at Sturrock Dock, Capetown and Captain Cook Dock, Sydney.

Modern Dry Docks—continued

Fig. 3. Pumphouse of Captain Cook Graving Dock, Sydney.


200 H.P. SLIPRING INDUCTION MOTOR
MOTOR STOOL HOUSING THRUST BEARING FOR ALL ROTATING PARTS
27" GWYNNE-GLENFIELD SELF-CLOSING DISCHARGE VALVES
30" ELECTRICALLY OPERATED SUCTION SLUICE VALVES
29'3"
PUMP DISCHARGE CULVERT
30" SLUICE VALVE
OIL PRESSURE PUMP FOR VALVE
MAIN DOCK SUMP
SECTION ON LINE A. A.

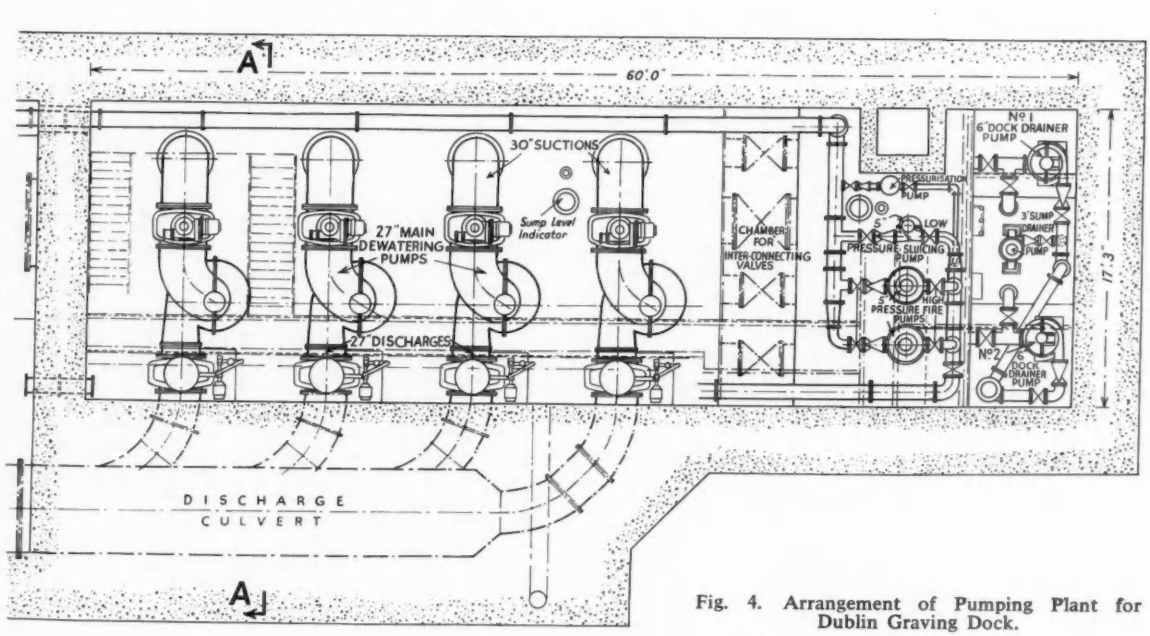


Fig. 4. Arrangement of Pumping Plant for Dublin Graving Dock.

Modern Dry Docks—continued

Type "B." These pumping stations are formed in the dock wall and are not separate structures as in the case of Type "A." Some of the advantages of this design are as follows:—

(i) Considerable saving in the cost of construction.
(ii) It is sometimes possible to reduce the length of the suction, discharge and filling culverts to a minimum.
(iii) Two or three independent pumping stations may be situated on each side of the dock, thus considerably reducing the possibility of total destruction of the pumping machinery due to military action.

In most cases it will be advisable to employ vertical spindle pumps for this arrangement. They can each be installed in a separate pump well with interconnecting passages at a level above high-tide. The roof of the pump wells will be flush with the coping and the removable covers designed so as not to interfere with the crane rails. For overhaul or removal of the pumping machinery, the dock-side cranes are employed. While under normal conditions all the pumps are controlled from a central position situated on one side of the dock, arrangements are made so that each pump can be separately started and stopped by means of control switches in the individual pump wells. Fig. 6 shows the arrangement of the pumps in a naval dock in the Far East. The pumping equipment and filling valves are contained in separate chambers constructed as part of the dock wall. Two sets of equipment each including two 20-in. main de-watering centrifugal pumps are installed in each dock side wall. Where a dock will have intermediate caisson stops, the pump wells can be situated so that the pumps are conveniently near to the separate suction gratings in the floor of the dock.

Type "C." The third type of pumping station is one which is required to de-water a number of separate dry docks. It has to be situated at the most convenient position, taking into account the run and size of the culverts and other local conditions. It is probably more like Type "A" station described above and may have either horizontal or vertical spindle pumps.

Recent researches have shown that the performance of pumps may be marred by the presence of vortices in the suction chambers[2, 3]. These vortices may be set up by bad positioning of the culvert entry to the sump or by the pump suction pipes not being arranged correctly in the sumps. When the water level in the dock is still fairly high, a vortex may take the form of a rotating core of water of considerable length, passing right up the suction pipe and disturbing the proper flow conditions in the eye of the pump impeller. As the level in the dock falls, conditions may arise where the core of the vortex may be filled with air and disturbance to the correct running of the pump is even greater. Frequently it is worthwhile constructing a small working model of the suction sump and culvert so as to find if any corrections have to be made.

When the main pumps are stopped suddenly either intentionally or due to a failure of the electric supply, the velocity of water in the suction culverts is quickly decelerated. This gives rise to an increased pressure in the suction sump which should be estimated when designing it, bearing in mind that this pressure rise may be superimposed upon that which occurs with a full dock. It is, of course, necessary to provide ventilating shafts to the suction sump and also possibly access shafts and precautions must be taken to prevent flooding from occurring due to a rapid up-surge of water in these when the pumps are suddenly stopped.

TYPES OF PUMPS

Main Pumps

In most dry docks, especially the larger ones, double inlet centrifugal pumps are used. They may be of either the horizontal or vertical spindle type and in the latter case the driving motor may either be mounted immediately on top of the pump or on steel girders at a higher level. With this type of pump the bearings may be external to the casing so that they are not subject to damage by abrasion from sand or other gritty material which is present in the water.

Single inlet centrifugal pumps may also be used but when of the vertical spindle type, they do not lend themselves so easily to the provision of a suction sluice valve. In both types, the casings may be split in a plane coincident with the shaft, so as to facilitate dismantling and inspection. This is quite a straightforward design in the case of the double inlet pumps but in most cases where single inlet pumps are used, dismantling is usually achieved by the removal of a cover on the top of the pump.

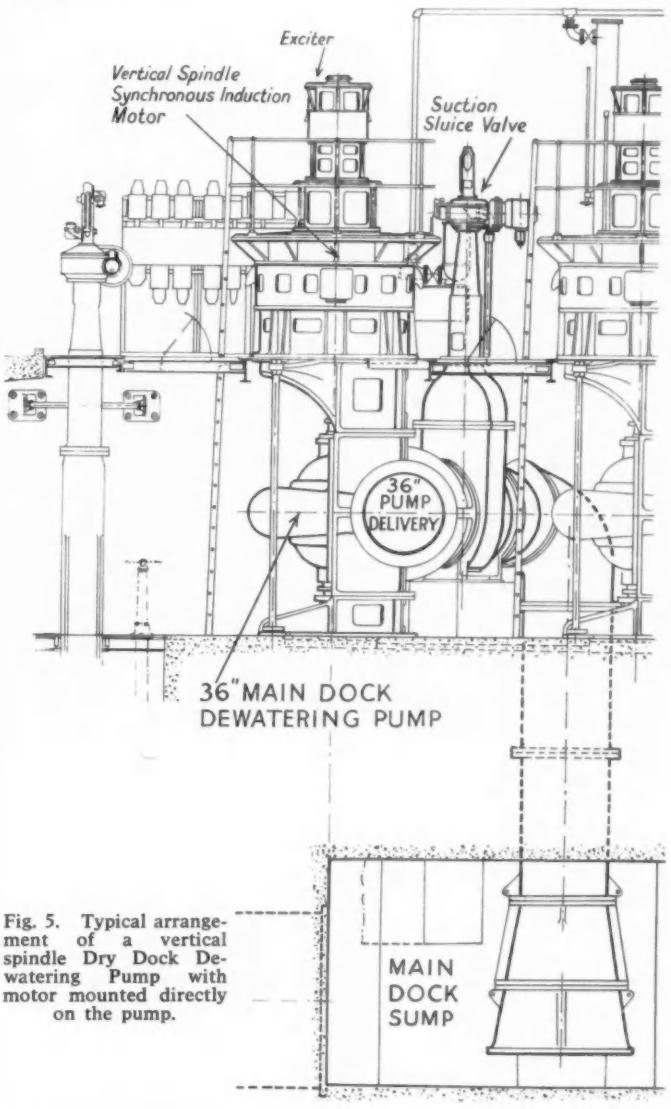
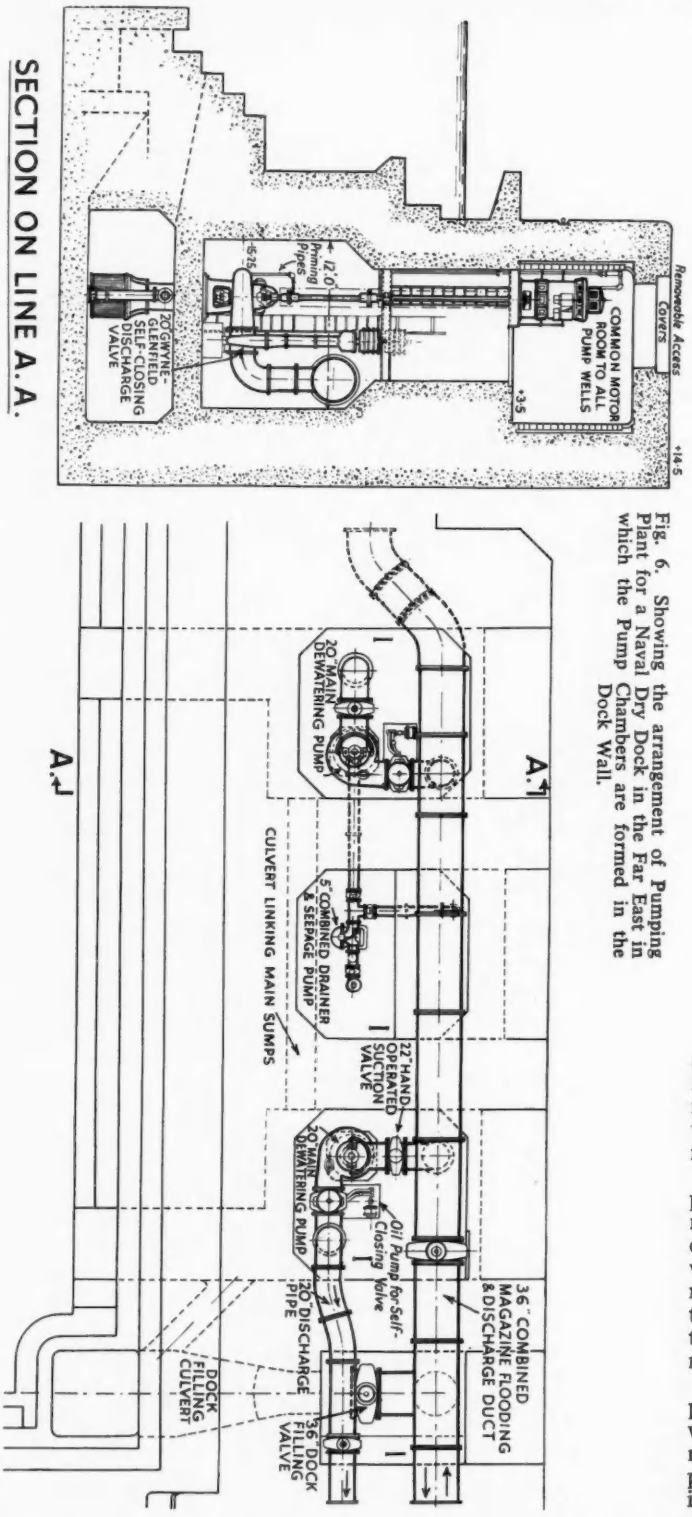


Fig. 5. Typical arrangement of a vertical spindle Dry Dock Dewatering Pump with motor mounted directly on the pump.

Mixed flow pumps are sometimes used for dry dock dewatering especially when the space available for the pumps is limited. Fig. 7 shows a typical section of a mixed flow pump and it will be seen that the space is saved by the absence of the volute; the water passing through guide vanes in a "bowl" where the velocity energy is recovered. The pump can be suspended into the suction chamber or installed in a dry chamber with the suction pipe passing either through the floor or through a wall into the suction chamber. It is usual to arrange for the impeller to be situated at a sufficiently low level so that it is always submerged when there is water in the dock and consequently priming is not required. The pumps must have internal bearings and special precautions to avoid excessive wear from abrasive material in the water have to be taken. A disadvantage of this type is the greater amount of work required to dismantle for inspection or overhaul. In most cases this involves raising the whole pump up to ground level. These pumps are especially

Modern Dry Docks—continued



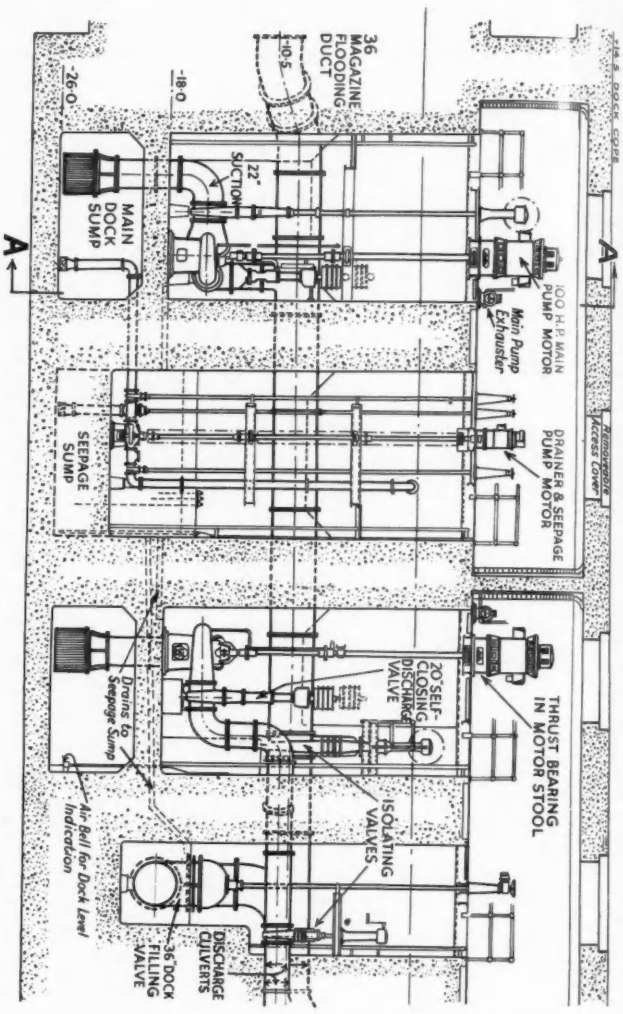


Fig. 6. Showing the arrangement of Pumping Plant for a Naval Dry Dock in the Far East in which the Pump Chambers are formed in the Dock Wall.

suitable for adaption to existing conditions and in many cases have been used to replace steam driven pumps, an example being 1400 B.H.P. pumps which were installed in this country before the war.

Axial flow pumps can be arranged in the same manner but unless the dock is a very shallow one, it is usually necessary to have a multi-stage axial flow pump having two or even three impellers. The reason for this is that it is a characteristic of axial flow pumps that the head which can be effectively generated by a single impeller is relatively low as compared with a mixed flow or a centrifugal impeller and consequently two or three may have to work in series to generate the required maximum head during the de-watering operation.

The characteristics of the performance of the three types of pumps vary quite widely as will be seen from Fig. 8. It will be noted that in the case of the centrifugal pump which may be either of the double inlet or single inlet type, the power absorbed when starting to empty the dock against a very low head, does not change very much during the pumping operation up to the time when the dock is empty and the pump is working against the maximum head. When the discharge valve is closed and no water is flowing, the power absorbed is still reasonably low.

It will be seen that, in the case of the mixed-flow pump, the power rises more rapidly as the quantity decreases but that, with the axial-flow pump, the power may be over twice the normal power when the quantity has been reduced to zero. This particular feature of the characteristics of the pumps is a very important one if it is desired to control the rate of discharge of water from the dock by throttling with discharge sluice valves. It means in fact that this form of control cannot be used with axial-flow pumps unless a motor of abnormally high power is employed. Where, for some other reason, it is especially advantageous to use axial-flow pumps, variable pitch impeller blades may be used and if the control of the blade angle is effected while the pump is running, it can be adjusted so as to give approximately the same horse-power characteristics as the centrifugal pump but, of course, with some sacrifice of simplicity.

Modern Dry Docks—continued

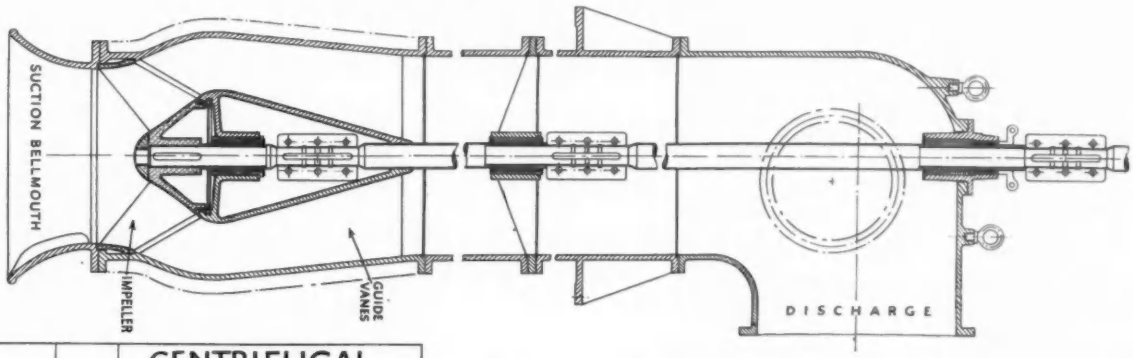
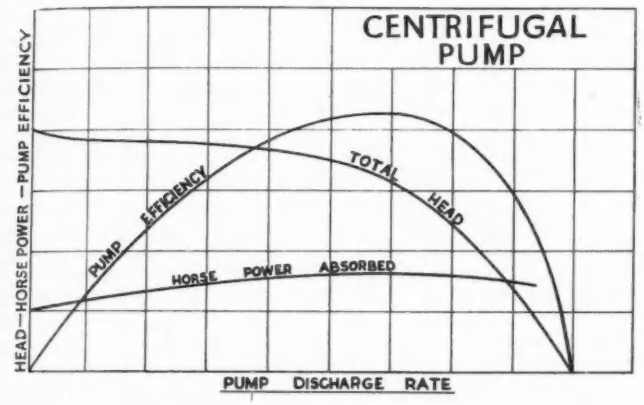
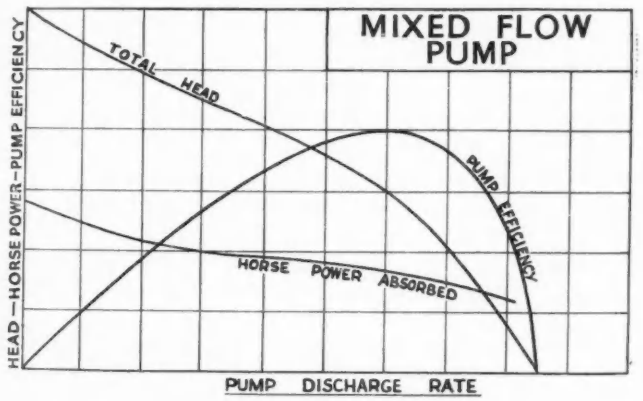


Fig. 7. Typical section of Mixed Flow Suspended Dry Dock de-watering pump.





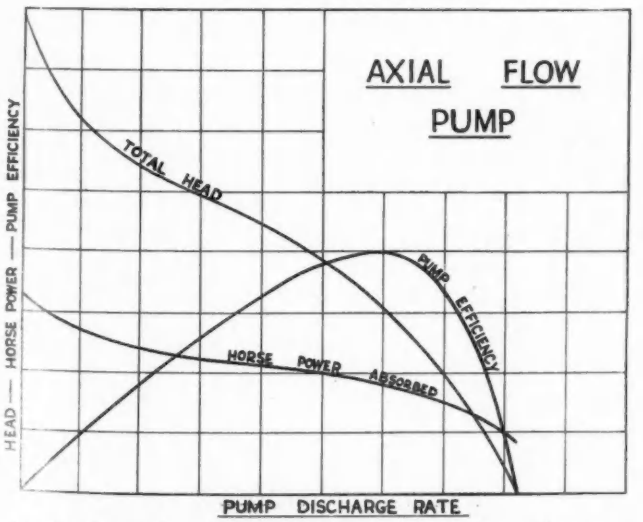


Fig. 8. Comparison of characteristics of different types of pumps used for dry dock de-watering (constant speed curves).

In general it should be borne in mind that the dock de-watering pumps have to work satisfactorily under conditions where the head varies from a very low value up to the maximum and that, in consequence, the hydraulic flow conditions particularly in the eye of the impeller, will be much less favourable than if the pump was operating continuously at its maximum efficiency duty.

Furthermore, for some part of the operating period, the pump is working with an increasing suction lift which reaches its maximum just before the pump is stopped. To minimise the damaging effect of these unavoidable conditions, the pump should be designed for a low velocity of entry to the impeller and also a low peripheral speed of the inlet tips of the impeller blades. This may mean the use of a larger impeller than would otherwise be required and consequently a lower rotational speed. While it is appreciated that the running hours per annum of dock pumps is relatively short, it is no doubt more economical in the long run and more satisfactory to employ relatively slow speed pumps which are specially designed for the onerous operating conditions although they may be slightly more expensive in the first place.

The selection of the most suitable materials for the construction of the dewatering pumps is not an easy task. In general the pumps are usually constructed with cast iron casings, gunmetal or zincless bronze impellers, and with steel shafts protected from contact with the water by gunmetal or other non-ferrous metal sleeves where they pass through the pumps. In some cases satisfactory results have been obtained by using nickel iron impellers. Special materials may sometimes have to be used when the dock is situated in a river or at the mouth of a river and the water is contaminated by various corrosive effluents. In such cases it may be found necessary to resort to nickel iron casings with, perhaps, impellers of a suitable grade of stainless steel. The damage to the impellers and the casings may be caused by chemical action accelerated by erosion from gritty matter in the water and, of course, the presence of corrosive material will severely aggravate the damage from cavitation which might otherwise be unimportant.

Where internal bearings have to be employed, as is usual in the case of mixed-flow or axial-flow pumps, and where impeller blade pitch adjusting devices are used, very special precautions have to be taken to exclude abrasive material and to prevent damage from corrosion.

(To be continued)

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Lighters and Lighterage

With special reference to the Port of London*

By P. S. HENMAN, M.Inst.T.

A LIGHTER is a large open barge for loading and unloading vessels, but the word "lighter" is not synonymous with the word "barge." In ancient days, the term "barge" was applied fairly generally to all those vessels which had the common characteristic of affording as large a hatchway as possible, with a corresponding minimum of deck area, which made for easy and quick handling and therefore cheapness in loading and discharging cargoes. However, the term was also applied to vessels carrying passengers as well as cargo.

It is believed that so far as London is concerned, lighterage is as old as the first century, when the ancient Britons used their coracles to help unload the Roman galleys. From the fifteenth century onwards, there are many evidences of the development of a thriving lighterage industry; and barges and wherries helped to carry merchandise from vessels moored in the Thames to various landing places and wharves. It is a characteristic of history that towns and cities tended to become established on estuaries and rivers. Trade was local, for communications were bad. The packhorse and the small craft were alone available for the movement of goods. Bridges were scarce. Small craft, usually of flat-bottomed construction, were used for ferrying passengers and goods across the watercourses. Warehouses on natural wharves were established on the banks of rivers and cross-river trade was brisk. In the fulness of time, larger seagoing ships were constructed, to be followed by the development of coastal traffic, the opening up of short sea trading, and finally, a system of world-wide shipping communications. In the evolution of this maritime trade, the flat-bottomed small craft has played many parts.

Originally, ships proceeded to natural harbours or ports situated on nature's rich endowment of estuaries and rivers and as these ships grew in size, they were unable to moor alongside the wharves more or less created by nature and they lay in safe anchorages in midstream or thereabouts, where they had a good depth of water and were protected against the fury of wind and waves. The barge or lighter was the sole medium for the discharge and loading of goods, the means for handling cargoes being the somewhat primitive ships' appliances. These small vessels also provided for passengers the means of access to and from the shore. Increased traffic required not only an increased number of ships but also an increase in the size of ships; so much so that congestion became acute, whereupon capital was provided for the construction on the banks of the main rivers of suitable dock installations for the berthing of ships of all types and sizes.

The use of flat-bottomed small craft for the ferrying of passengers thereupon eased. Cargoes began to be discharged and loaded directly between ships and quays and it became manifest that to avoid quay congestion and to speed up the turn-round of ships, the services of the flat-bottomed local vessels were a necessity. Shore cranes handled goods to and from quays, while ships' derricks were engaged in a like operation to the barges or lighters. Thereafter, these small craft proceeded to wharves and warehouses situated on the river banks where handling of the traffics took place.

It is significant that, when parliamentary powers were obtained for the construction of docks at the great ports of this country, a clause was usually inserted in the appropriate Bills conferring in perpetuity for all small craft the right of entrance and egress to these docks without payment of any dock dues. This was a reasonable and natural arrangement, benefiting all parties, for the construction of docks did not confer any benefit whatsoever on small craft owners but on the other hand, these owners were able to continue rendering a valuable service to the speedy turn-round of ships and were also able to confer appreciable benefits on the dock companies in reducing quay congestion. The Hull lighterage interests have recently made representations against the proposal of the British Transport Commission to abrogate this ancient protection conferred by Parliament.

Many years have elapsed since small craft were the sole means of discharging and loading ships in England or on the Continent, but in many of the under-developed countries of the world the position still holds whereby ships moor in safe, protected fairways and flat-bottomed boats are used for ferry services to and from the shore. Late in the eighteenth and early in the nineteenth centuries, trade in England was suddenly galvanised by new methods of communications—the packhorse was supplemented by the construction of canals and by the creation of suitable navigations far inland on certain river highways. Subsequently, the railways revolutionised inland transport, to be succeeded by motor vehicles. When the inland navigations were created, it became the practice to send inland small craft loaded with goods and propulsion was afforded, in the main, by sails and horses. A return journey could occupy a week or more and this necessitated the provision of suitable sleeping quarters on the small craft. In this paper "barges" refers to those craft which afford sleeping accommodation and, as such, are subject to special regulations made under the provisions of the Merchant Shipping Act. "Lighters" relates to those flat-bottomed vessels which navigate in the main rivers and estuaries on which the principal ports are located and which do not travel far into the hinterland.

Types of Lighters

There is a wide range of type, for lighters are to be found in practically every port and river in the world and are designed to suit local conditions. Many types which were formerly numerous in England — the Severn Trow and the Tyne Keel, for instance—are dying or are already dead, and even the Thames and Medway spritsail lighter, one of the most picturesque, interesting and elaborate of its type, is rapidly disappearing, and now appears usually once each year for the sailing barges race in the Thames Estuary.

Whereas, for many years, lighters were invariably built of wood, principally oak, steel is now used, not only for whole fabric and shell plating, but also, very often, in place of wood on the ceilings or floors of the holds where the cargo is stowed during transit. The practice of using a welded rather than a riveting technique in craft construction, which developed rapidly during the years 1939-45, has spread to lighter building and many, but not all, of the craft built since the war are of a welded type. Probably the chief reason for the stronger specification used in England, when compared with the Continent, is the fact that craft have to take the ground fully loaded sometimes twice a day, which imposes stresses and strains far greater than those experienced in waters where the craft always remain afloat.

Not only do lighters vary considerably in size, but they contrast sharply in shape and specification, mainly because of the operating conditions on the particular waterway served by the craft concerned. The average modern steel lighter is relatively inexpensive to build and maintain because of its simple shape and structural detail and because of the absence of machinery and elaborate living and deckhouse accommodation. It carries 3½ to 4 times its own weight of cargo in one or more large holds or in tanks fitted in its hull, and its life, while varying with its specification and use, frequently exceeds 30 years; there are examples to be found of lighters in use to-day which were

* Paper read before the Humberside Section of the Institute of Transport, November 19th, 1957, and reproduced by permission. The author is Chairman and Joint Managing Director, Transport Development Group, Ltd.

Lighters and Lighterage—continued

built more than 60 years ago. By careful repair and adequate maintenance and renewals, the useful life can be increased considerably.

Modern lighters range in dimensions from 60-ft. to over 140-ft. in overall length, from 14-ft. to 30-ft. or more in beam and from 4-ft. to 15-ft. or more in depth. They carry cargoes of up to 500 tons. The usual British size is about 200 tons. The dimensions of lighters are determined by the depth of the waterways over which they travel, by the berthage accommodation available and by lock dimensions where artificial or canalised navigations have to be negotiated.

Because a given quantity of cargo moving at a given speed will have less resistance in a single, well-designed lighter, than in two smaller ones, designers strive to produce a vessel giving the maximum carrying capacity which the physical characteristics allow. This also permits of a saving in operational labour costs.

For operations on artificial waterways, the closeness of the banks on either side make high towing speeds undesirable, because of bank erosion, with the result that lighters operating on such navigations tend to have short rakes.

On the open Thames, the punt-shaped lighter has evolved as an efficient unit. These vessels are swim-ended to assist the lighter's speed ("swim" meaning "glide"), that is to say, the bottom of the barge is turned up at forward and after ends, to meet the deck at an angle of 35°—40°. These ends are called forward and after swims and the after one has a budget (or fixed rudder) worked down the centre, formed through the continuation of the keel plate to the extreme end of the swim. This is filled in up to the swim. It is owing to this budget that these craft can navigate on a straight course, whether being rowed or towed.

On the Humber and other British rivers and, indeed, on the Continent, stem-headed lighters prevail. With a rounded bow, they respond more readily to the rudder and this is important for their safety, as they voyage at times over turbulent waters, having to be towed on very long ropes. All self-propelled lighters are stem-headed so as to achieve maximum navigational control and efficient response to the helm.

In North America, however, most lighters are like square-ended, flat-surfaced pontoons, where they can be pushed or pulled by tugs. The cargo is mainly carried on deck in containers including rail trucks, road wagons, etc., and these containers are moved bodily on and off the lighter as necessary. The normal train comprises four, six or eight vessels.

In the old days, lighters were rowed about by men, or towed from the banks by horses or worked on the tide with primitive square-sails. Sometimes all three methods were used during the course of one voyage. Movements are now effected almost entirely with towage power supplied by a tug, a motor vessel or a tractor.

In the case of the Thames, under normal conditions, craft make their journey on a tide and lock in a dock, or berth at a wharf, before or by high water. They are towed by tugs in trains which comprise up to six at a time. If each dumb lighter was self-propelled, it might reach its destination more speedily than the same lighter voyaging as a constituent member of a tow, but it would gain very little as it would, in most instances, be obliged to wait until just before high water to dock or berth. Additionally, however, as the lighter is a carrying unit and used often as a floating warehouse, capital invested in the engine would be quite unproductive during non-voyaging periods, labour to attend to the engine would be expensive and profitable cargo space would be lost by the size of the engine room. Much more time is spent by lighters in loading and discharging and in waiting to load and discharge than in actual movement, say 4 to 2. Hence, for dock work and local port activities, the dumb lighter towed by tugs is the recognised economic method of carriage.

Lighters can be adapted for the carriage of all types of traffic. Apart from the normal general merchandise (whether in bags, packages or bulk) insulated vessels carry frozen meat, butter, fruit, vegetables and other perishable cargoes; tanks are fitted for the conveyance of liquids in bulk; steam coils are provided to enable cargoes to be heated for pumping and discharge, and the latest innovation is a lighter designed to carry cement in bulk, discharge being facilitated by means of built-in agitators. There are open lighters for the conveyance of coal, timber and refuse; there are hatched lighters affording protection against damage to cargo; and there are also locked-down hatched vessels to meet the requirements of Her Majesty's Commissioners of Customs, when lightering dutiable goods under bond.

In Hull, lighters are almost wholly engaged within the confines of the port. Most of their trade is between the Hull docks and those mills and warehouses situated on the banks of the River Hull, but there is additionally a certain amount of dock to dock traffic. The lighters are not fitted with living accommodation and are manned as required to be loaded, discharged or moved. The men engaged on them are all port transport workers engaged from the National Dock Labour Board.

It is estimated that there are between eleven and twelve hundred small craft regularly plying for trade in the Humber, and of this number, 350 are dumb lighters and their total carrying capacity is roughly 70,000 tons. Most of these lighters are constructed of steel, though a small number of wooden-built lighters still remain. There are about fifteen lighters fitted as tank craft and there are no unhatched vessels operated in Hull. With the exception of cargoes loaded and discharged in the same dock, all lighterage work entails movements in the River Humber and it is impossible for craft to navigate the river without being fully hatched and covered.

The London Lighterage Service

Probably London has the largest port lighterage service in the world and there are no less than 6,600 dumb lighters on the port register:—

Hatched	Approximately	2,200
Open	,,	4,000
Tank	,,	400

served by some 400 tugs:

Motor	Approximately	300
Steam	,,	90

ranging from 20 up to 500 horsepower. The combined carrying capacity of these lighters is probably over one million tons.

The London lighterage industry comprises a collection of undertakings, one hundred or more, owning fleets from as few as two to as many as one thousand craft. There is no particular pattern because most of the undertakings and fleets have been brought into being by traffic requirements rather than, as is sometimes the case, the provision of facilities attracting a traffic or meeting a demand. There are few fleets which are confined to one class of traffic, except those of merchant lightermen, although there are groups of specialised craft, used for the carriage of petrol and spirit, for bonded goods, for refrigerated cargo requiring insulated craft, and for other appropriate traffics. Lighterage in London is a "tailor-made" service to meet a variety of conditions rather than a standardised organisation where uniformity is the order of the day.

It is estimated that about 60 per cent. of the goods traffic of the Port of London uses lighters at some stage or other. This is a very substantial tonnage for the official figures of the trade of the Port in 1956 showed 52 million tons. A more detailed estimate shows that 70 per cent. of the overseas imports dealt with in the docks are conveyed from the ships by lighters to wharves, railway depots and factories, while 50 per cent. of the overseas exports are conveyed by lighters. In addition, a proportion of the cargoes of vessels at the river wharves is delivered overside to or from lighters. The varieties of traffic handled are immense.

Tradition has established a broad general classification of the Industry:—(a) The Quay Goods Section, which deals with general cargo or fine goods. The name is a derivation from the oldest times when this class of goods was taken to legal quays on the riverside and there warehoused in co-operation with the Customs authorities, and (b) the Rough Goods Section, which deals with coal, ballast, refuse and the like.

This broad classification is of importance in that it dictates two separate systems of working. With Quay Goods traffic,

Lighters and Lighterage—continued

Registered Port Workers are allocated to employers by the National Dock Labour Board and they are paid on the basis of a daily rate of wage. In practice, however, practically all the men regularly follow their own firms and very seldom, if ever, go back to the National Dock Labour Pool, and in this way, spend all their lives with one firm as their fathers and grandfathers did before them. In these circumstances, it seems farcical that these men should be regarded as employed on a daily basis. Unfortunately, it has not been possible to establish a system of weekly or permanent engagement by agreement with the Trade Union concerned because the Union insists that every registered lighterman in the Port must be absorbed into weekly engagement or, alternatively, none may be so engaged. The paradox lies in the fact that the National Dock Labour Board was established solely to deal with a situation where casual labour is necessary to be industry and lighterage firms claim the right, in common with all other port employers, to have a marginal floating population of men available to meet not only the seasonal fluctuations in the industry but the almost daily fluctuations of traffic between one firm and another. If weekly engagement could be arranged, lighterage costs might be reduced.

The men employed in the Quay Goods Section are allocated

Ship discharging simultaneoulsy to shore and to lighter alongside.

to jobs on various lighters from day to day, for the work has to be fitted in with the loading and discharging hours of ships in the docks and with the working hours of the wharves. On the other hand, in the Rough Goods Section, where there is a large bulk traffic (for example, coal), a complement of lightermen is attached to a tug and they constitute the hands for the lighters which are towed about in the river during the course of the tug's working shift. All the men employed in the Rough Goods Section have weekly engagements.

Licensing of Lightermen

There is a statutory requirement that a London lighterman, in order to be in charge of a vessel navigating or towing on the river, must be a licensed man so that, if a tug is towing six lighters, there must be six lightermen. This provision goes back to mediaeval times, but the licensing system was perpetuated by Act of Parliament when the Port of London Authority took over the Docks in London in 1908. Licensing is the responsibility of the Port of London Authority, but in practice the duty of examinging the applicants and issuing licences is delegated to the Court of the Watermen's Company, who have always carried out those functions. The general system of licensing is through an apprenticeship system, whereby a youth after leaving school, is apprenticed to a Master, serves two years as an unlicensed apprentice in the industry and then applies for his apprentice's licence or two years' papers, as is commonly described. If he satisfies the Court of the Watermen's Company that he has acquired sufficient knowledge, the apprentice receives his two years' papers and then goes on to serve the remainder of his apprenticeship period, finally becoming a fully licensed lighterman and a Freeman of River. The licensing system seems to be peculiar to London and is guarded very jealously.

The lightermen have their own union, the Watermen, Lightermen, Tugmen and Bargemen's Union, whose members number approximately 3,500. The vast majority of the port workers in London are attached to the Transport and General Workers' Union, with a membership of 19,000, and to the National Amalgamated Stevedores and Dockers' Union, which has a membership of approximately 4,000.

The advantages of the licensing system are that it provides an efficient training for a youth and gives him a sense of responsibility, while at the same time ensuring that when he receives his licence, he has been certified as competent by an authoritative body. Having regard to the highly technical nature of the lighterage industry, the importance of safe navigation and the high value of the vessels and their cargo, it would seem essential to its well-being for the industry to recruit, train and preserve a body of men known as licensed lightermen to man and handle the fleet of tugs and lighters.

However, the licensing provisions apply only to those manning lighters using the river and do not apply to the crews of tugs navigating in the river and docks or to the men employed on lighters in the docks and on the system of artificially-constructed waterways although, in practice, the large majority of men employed in these areas are licensed men. Under modern conditions, when practically all the movement of vessels in the Thames is performed by tugs, the preservation of the exclusive statutory right of the licensed men to man the lighters on the tideway may be open to question.

Registration of Lighters

The jurisdiction of the Port of London Authority extends from Teddington to the Nore and all small craft using this section of the Thames waterway must be registered with the Authority and pay to it a basic annual fee of 9d. per net registered ton. The lighters do not have to be registered separately with the Ministry of Transport, as applies to lighters elsewhere, and indeed, to British ships generally, but by virtue of registration with the Port of London Authority, the provisions of the Merchant Shipping Act are automatically extended to them.

Use of Tideway

There are no tolls payable for the use of the river (except above Kew) or for the creeks, or in the docks; but if craft dock more than two tides before the arrival of the vessel for which they are docking, or remain in dock for three tides after completion of loading, dock dues are levied, the present charge being 9d. plus 10 per cent. per net registered ton.

Wharfinging

London has established over the years a reputation as a great warehousing port. Ownership of the public warehouses is divided between the Port of London Authority and private wharfinging concerns, supplemented by some public warehousekeepers whose premises are not water-served and are outside the dock areas. The pre-war capacity of the warehouses of the Port of London Authority, including timber storage sheds, amounted to 15 million square feet, of which 8½ million square feet were lost by enemy action. It is estimated that the pre-war capacity of the riverside warehouses was rather greater, but it, too, suffered heavy loss. The large number of riverside wharves constitutes an important part of the port facilities of London, as the following analysis will show:—

(i) Privately-owned public wharves	314
(ii) Private wharves, other than those of gas, electricity and water undertakings ...	234
(iii) Wharves of gas, electricity and water undertakings	25
(iv) Coal wharves	29
(v) Oil wharves	37
	639

Lighters and Lighterage—continued

These figures refer only to the total number of separate wharves, and give no indication of their relative significance or the importance of the undertakings by whom they are provided. Nevertheless, the number of the wharves and the size of their warehouse accommodation gives some idea of the vital part played by the lighterage industry in the handling of traffic in the port. In this respect, London differs from Liverpool, where there are practically no private wharves. Hull offers a similarity to London on a very much smaller scale.

Road transport is used primarily for the oncarriage from private wharves to inland destination. British Railways have docks and wharves at Poplar, Brentford and Deptford, and Nine Elms, providing some 15,000-ft. of quayage, mainly devoted to handling lighter traffic, and serving as a feeder to the railway system. The port lighters also maintain intensive traffic services over the connecting waterways of the British Transport Commission at Brentford, Regents Canal, Limehouse Cut and at Bow Creek for the River Lee. The annual tonnage passing over the Lee Navigation is nearly 2½ million tons. Lighters also provide a service on the Port of London Authority's Grand Surrey Canal.

All wharves depend in varying degrees upon the Free Water Clause under which goods can be delivered to or received from lighters overside in the docks and conveyed to and from the wharves without the payment of dock dues on the lighters or goods. Without the service performed by private wharves, which are fed almost exclusively by lighters, the accommodation of the Port of London Authority would not suffice to handle the volume of deep-sea ships arriving in London.

Lighterage Rates

Rates for lighterage services in London vary a good deal according to commodities, the length of the haul and various other considerations, including whether the loading or discharging points are on the riverside itself or on the artificial waterways. There is no general tariff of charges.

The burden of replacement costs of fleets is a factor which presents problems now which will increase as pre-war fleets require to be renewed. In 1936—38, the straightforward dumb lighter with a carrying capacity of 200 tons cost nearly £1,000, i.e. £5 per ton of carrying capacity. To-day, the same type of lighter requires an outlay of about £5,000, or £25 per ton of carrying capacity. The serviceable life in each case would be about the same. Thus, there has been a five-fold increase in capital cost during the past two decades.

The average comparable capital costs of road vehicles have not increased by the same ratio, for in 1938, a 5-ton petrol motor lorry cost £65 per ton of carrying capacity, and to-day the figure for the same machine is £210, which is slightly more than a three-fold increase in price. The life of this motor vehicle is relatively short, say five years, and because of this short life, the effect of steady inflation on capital cost is more obvious so that this increasing burden, measured by depreciation, is promptly taken into account in fixing traffic rates.

However, the life of a dumb lighter is much longer, say 25 years, and therefore, the incidence of the cost of replacement of lighters constructed in the pre-war era is less obvious, may be overlooked and can lead to inadequate provision being made and to the quotation of unrealistic traffic rates. This problem must be met. The general approach is to revalue lighters to a more realistic figure with a resultant increased charge for depreciation and the quotation of a more realistic traffic rate. The depth of the problem has been recognised by the Government in so far as a lighter is treated as a ship and an investment allowance of 40 per cent. is given by the Inland Revenue authorities in respect of purchases of new craft.

Justification of London Lighterage Industry

What is the economic justification for the lighterage industry? Sufficient has been said to indicate the service it has performed over an extended period of time. The service is now, if anything, more important, having regard to the increasing tonnages arriving in the Port of London and causing still further congestion to the already overburdened dock installations. The railway companies are unable to transport to and from the docks the total tonnage involved, and physical considerations rule out the possibility of more motor vehicles collecting and discharging goods at the quayside. Hence, the natural and economic function of the lighter is to disperse the cargoes to the many wharves which are well equipped for the handling of all types of traffic. It is in the national interest that the already highly congested thoroughfares in the metropolitan area of London should obtain relief, and gigantic schemes have already been mooted for expensive road widening operations and for large demolitions so as to permit the construction of new highways. The schemes must be brought to fruition. But a speedy and relatively cheap solution to a part of this problem can be effected forthwith in so far as economic waterways can be enlarged to enable the passage of port lighters to destinations on the outer perimeter of the metropolitan area. The creation of traffic transit sheds and suitable terminals is simple. More and more motor vehicles from all industrial areas will thus be able to collect and deliver shipping cargoes via the lighterage industry without the necessity for journeying through the inadequate and already overcrowded streets in London and its suburbs. Loss of and damage to individuals' lives will diminish and this is a national

Lighters in West India Dock, Port of London.

benefit of the highest value and an economic justification which defies calculation.

The enterprising capital expenditure programme of the British Transport Commission on its Greater London network of waterways—the biggest scheme of waterway improvement since they were built—will facilitate the movement of larger craft over longer distances. This will help to rejuvenate certain waterways which have always had a traffic potential which has not been realised because of the uneconomic pay-load which can be carried at present. The widening of the locks at Brentford will enable lighters comparable in size to those which travel on the River Lee to proceed further inland and will open up a new channel of communications for many vessels which are now limited to selected routes. In this way, greater efficiency will be promoted. The London lighterage industry is well poised to make its full contribution to the possibilities offered by the initiative of the Commission and the State. In this connection, port authorities generally will do well, through the medium of the lighterage industry, to disperse cargo over the banks of their navigations, especially as the further construction of wet docks is almost impossible.

The size of the lighterage industry in London is due to its efficiency and to the contribution which it makes, without subsidy or monopoly to the essential working of the Port. It enables two-way loading and discharge to proceed at the same time. It speeds up the discharge of ocean-going ships. It is continually acquiring and perfecting new techniques designed to improve its service and reduce its costs. It has its own local problems but it is proud of its tradition of service over hundreds of years.

Lighters and Lighterage—continued

The Future

"The old order changeth." Gone are the wooden barges propelled by oar and muscle. Gone are the leisurely winds and tides for motive power. Gone are the days when time was of no consequence. Lighters and lighterage must hold their own with the road vehicle, the diesel- and electric-powered train, the helicopter and the aeroplane, and maybe, one day, the space ship, or else yield place to the new mediums of transport. As the old order yields place to a new one, the three partners in the industry—manpower, money and management—will do well to ensure that each one of them is pulling its weight and putting into the industry the output, the finance and the thinking that will ensure for the lighterage industry its proper place and share in the transport systems of the world. Above all, there must be a real partnership unmarred by suspicion, greed, complacency and lack of enterprise.

Manpower must remember that wages come from freights and freights depend on costs and costs depend, in many areas, up to nearly 60 per cent. on wages. The industry must be able to stand on its own income, balance its receipts and payments and provide out of income sufficient money to replace and increase its carrying capacity. If the old order of wage structure

A modern lighter on the River Severn.

is unalterable like the laws of the Medes and Persians, then the wage-earner cannot complain if the new order does not include wages for the manpower of the industry. The lighterman's lot has been transformed to an even greater extent than that of the lighter and this can be maintained and improved only in as far as the industry can attract freight.

The money partner must ponder on the fact that the barge fleets of seven thousand-odd craft which operated in London in 1938 probably cost some £7 million to build, whereas the replacement of these craft at current quotations for new lighters will involve an expenditure of some £35 million—a truly massive sum. This being so, not only must the industry attract freight for its existence but fresh capital, too, and this presupposes the payment of adequate hire for the existing capital.

Management, which is the lynch-pin in the three-fold partnership, is set the task of attracting freight to the industry in the teeth of fierce competition from other forms of transport, out of which to pay wages which attract skilled manpower, and dividends which hold existing and attract fresh capital. The task of management is formidable but given brains, courage, foresight and enterprise, management should win for the industry its proper place in the transport system, providing the two other partners are prepared to put sufficient into the industry to attract freight. Without this co-operation, management could be powerless, but it should be said that part of their task is to show the other partners how they can help lighterage and, incidentally, help themselves.

Management will need to harness all the available resources of research to match the steep rise in the capital cost of craft and their operation. The metallurgists should be invited to produce metals which enable larger loads to be carried without greater displacements. Bodies such as the National Physical Laboratory at Teddington should be encouraged to experiment in design of craft and tugs. Naval architects must evolve new techniques in construction and repair, and such experts as chemists can, no doubt, continue the advances in all the other materials needed by the industry, such as ropes, tarpaulins, gratings, paint, etc. Time and motion study experts should throw into relief the wasting of human effort and time, and training programmes can up-grade the supervisory staffs employed in the industry, and in these and other ways, management can keep abreast of the times.

Grouping of lighterage fleets, which has been taking place progressively for some time, will continue until, maybe, there are only comparatively few operating companies, each controlling fleets of, say, many hundreds of lighters, with the possibility of reduced overhead and operating costs per ton of carrying capacity.

It may be that higher-powered tugs, controlled by radio-telephone, moving with or against the tide, can obtain a quicker turn-round of the barge fleets in daylight hours, and a speeding up of the loading and discharging will enable fewer barges to be used and therefore less capital employed to earn more freight.

In London, the wage agreements ignore tidal factors and there is fixed arbitrarily a working day from 8 a.m. to 5 p.m. and, widespread as the Industry is, an arbitrary focal point on the waterway is fixed notionally for commencing operations. How long this old order can be maintained is uncertain but the moment the industry loses freight by such an arrangement, manpower will need to ask "Where are the wages coming from in future?"

Provided the industry appreciates the principles of an ever-changing order and takes effective action to share in the new orders as they come in, there is a bright future for all three partners—manpower, money and management. Let these three rest on their oars and float with the tide, and they are lost; but let them stem the tide and drive forward into the future, then in a hundred years' time an epic story can be told, every bit as bright as the long and distinguished record of the service afforded by this essential industry throughout past centuries.

Mechanical Handling Exhibition and Materials Handling Convention

The 1958 Mechanical Handling Exhibition and Materials Handling Convention to be held at Earls Court, London, from May 7th—17th, is expected to be the largest display of labour-aiding equipment and methods ever presented to the world.

Occupying half-a-million square feet of floor space, the Exhibition will for the first time be international in character, with over 250 exhibitors displaying time and cost-saving devices from Great Britain, America, France, Germany, Italy and Scandinavia. At the Materials Handling Convention, which will run concurrently with the Exhibition, leading authorities will present papers dealing with the latest handling methods in particular industries.

The speakers will include Mr. E. S. Tooth, dock superintendent, Port of London Authority, who will read a paper entitled "Mechanisation Problems in the Port of London."

This in an Exhibition of greatest importance to all concerned with production. Exhibits will include the latest conveying and handling devices, cranes, industrial trucks, aerial ropeways, earthmoving equipment, lifting tackle and all types of equipment and accessories associated with mechanical handling. By studying these, and with the help of diagrams, photographs, films and working models of complete factory installations, the visitor will be able to see the many ways in which greater output and lower costs can be achieved.

Further information, details of the many facilities available to visitors, and tickets, can be obtained from the Exhibition Manager, Dorset House, Stamford Street, London, S.E.1.

Grouting of a Paved Earthen Sea Wall between Hythe and Dymchurch

An Account of Experimental Works by the Aerocem Process Carried out by the Kent River Board

By G. CUBLEY CROWTHER, O.B.E., M.Inst.Mun.E., M.Inst.W.E., F.R.S.H.

IN order to convey to the reader the importance and difficulties, and also the expense, which has to be taken into account in maintaining a length of sea wall of the character comprising the subject of this paper, the author has thought fit to include a short description of the wall itself and also some information he has gathered about its early history.

The Dymchurch Sea Wall is approximately four miles in length and lies to the south-east of Romney Marsh abutting upon the coast of the English Channel. Its very early history is somewhat obscure, but many centuries ago, after the Marsh was no longer subject to continuous tidal inundation, a wide embankment of sand and shingle, the result of natural accretion, existed considerably further out to sea than the present wall.

At a later date this natural protective bank became eroded and about 1500 A.D. it was in danger of being breached. By this time a considerable area of the Marsh was being used for agricultural purposes and works of protection were undertaken, consisting of the construction of a large clay wall protected by timber "faggot-work." It is also possible that some type of groyne was constructed as in 1612 A.D. there is an entry in the old accounts of the "Level of Romney Marsh" of an expenditure on the "Cartage of stone" for this purpose.

For many years the clay wall from "Grand Redoubt" to Willop Outfall, which is the length concerned in the recent experimental grouting, served to resist the destructive action of the sea and storm but serious erosion again became manifest about the year 1800 A.D. and work was commenced on the provision of a seaward facing of stone pitching. A curved "wave wall" was also constructed and below this was formed a long flat sloping apron of stone blocks, the local "Kent Ragstone" being the material used. Works of this nature proceeded year by year until the whole of this particular length was paved. It should here be noted that the blockwork was on the original clay of which the wall was constructed and formed a satisfactory protection so long as regular maintenance was carried out without delay, whenever small displacement of the blocks was caused by storm or exceptional tides.

About 1880, however, maintenance was sadly neglected and it became necessary after a few years to consider very extensive works of reconstruction to safeguard the Marsh against serious damage by the failure of the sea wall; repair works were put in hand but, presumably to minimise the cost, the apron was rebuilt with a steeper slope. This had the effect of making the stone pitching very much more prone to damage and maintenance became increasingly costly; about 1900 a series of groynes were constructed to assist in the accretion of beach deposit at the toe of the wall and to form additional protection. These groynes, although to some extent alleviating the tendency to scour, are liable to lose the beach at certain states of weather and tide and so themselves become "scoured" at a time when the protection is most needed.

The stone blockwork on the foreshortened apron is subject to continuous abrasion by the movement of shingle and sand so that maintenance works have been necessary throughout the period up to the present time. Prior to the Second World War in 1938-39 a scheme was prepared to reface this length of wall with granite and basalt blocks and segregate the various sections by timber bulkheads formed of sheet piling. The blocks were to be laid on good well punned plastic clay. The war period halted this work and financial conditions have made it impossible to undertake the scheme owing to the vastly increased cost of the work at present day prices.

During 1953-55 consideration was first given to the possibility of filling up the cavities under the existing paved apron with aerated cement grout: After several severe washouts had occurred, which (until hastily repaired at great cost) had endangered the safety of thousands of acres of very valuable marsh lands—much of which by this time had come under arable cultivation, the remainder being very good grazing pastures — the Board which has, since its constitution under the River Board Act of 1948, been responsible for the maintenance of the wall, decided to undertake a programme of experimental groutings with the co-operation of Messrs. Aerocem Limited.

It was realised that damage mainly occurred by water percolating through the joints of the blockwork apron which, on the receding of the tidal wave down the steep seaward face, scoured out a number of cavities under the apron, thus depriving it of its support; a continuing storm then

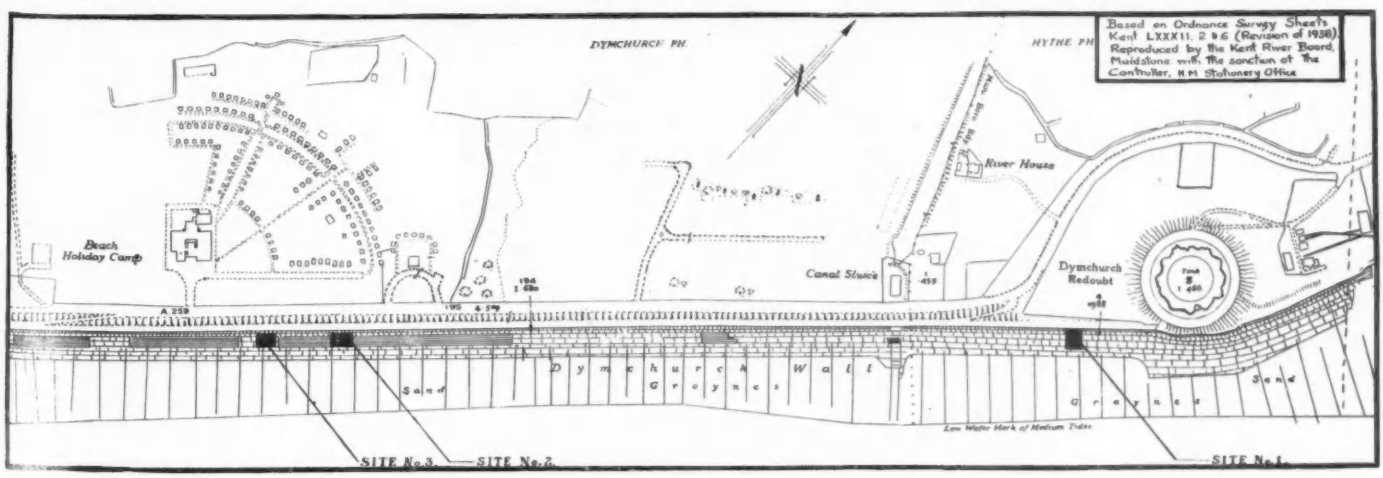

Based on Ordnance Survey Sheets Kent LXXXII. 2 & 6 (Revision of 1938) Reproduced by the Kent River Board, Maidstone with the sanction of the Controller, H.M. Stationery Office
DYMCHURCH PH
HYTHE PH
River House
Beach Holiday Camp
Canal Sluice
Dymchurch Redoubt
Dymchurch Wall
Groynes
Sand
Low Water Mark of Medium Tides
SITE No.3.
SITE No.2.
SITE No.1.

Fig 1.

Grouting of a Paved Earthen Sea Wall—*continued*

Fig. 2. General view of Site No. 1 taken from wall.

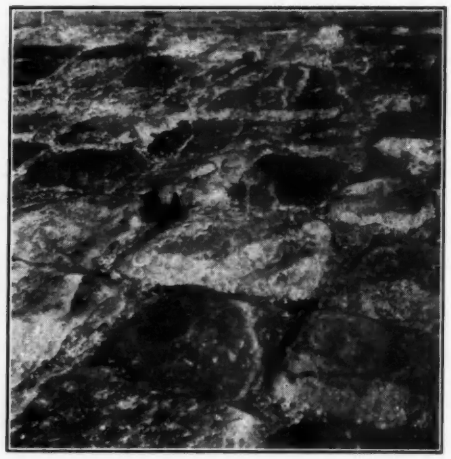


Fig. 3. Showing holes drilled and plugged prior to fixing grout pipes.

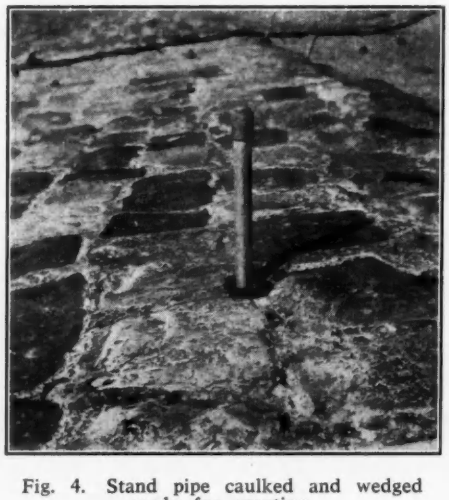


Fig. 4. Stand pipe caulked and wedged ready for grouting.

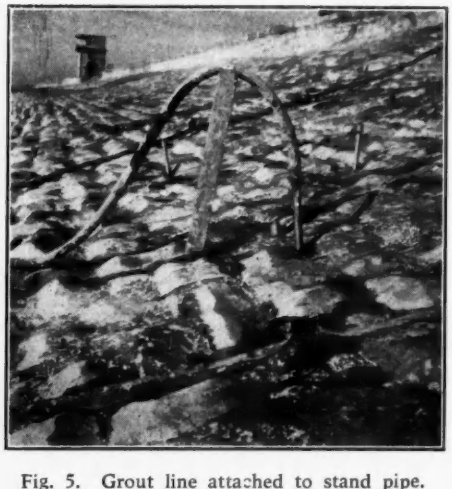


Fig. 5. Grout line attached to stand pipe. This direct coupling of pipe to pipe was later superseded—cocks were fitted to the grout lines and the stand pipe, thereby permitting a clean dis-connection to be made without blowbacks, especially from the standpipes. These cocks make the work much cleaner and safer for the man who does the coupling-up of pipes and subsequent breaking down again.

scoured out large quantities of the clay which was not always of good quality, being very often local material hastily excavated from time to time over periods of many years, without adequate selection, and used to fill up gaps as they appeared after previous heavy storms.

The alternatives which faced the engineers of the Kent River Board were, either to re-construct the whole of the lower portion of the stone facing, or adopt some means of stabilising the existing face, which was becoming more vulnerable owing to tidal wear on the blockwork itself and to weaknesses caused by hasty repairs to minor breaches which had become increasingly frequent and more costly to repair.

A complete scheme of reconstruction for the whole length from Grand Redoubt to Willop Outfall is estimated to cost about half a million pounds and one of the first stages in this work is the elimination of cavities underneath the existing stone facing. A series of experimental groutings on selected parts of the wall which were known to be more or less defective was accordingly carried out.

Three sites were chosen which will be referred to in these notes as Sites 1, 2 and 3 (see Fig. 1) respectively and the following plant was used on the site:—

(a) 4 cu. ft. Aerocem Cellular Concrete Mixer.
(b) One Aerocem Aerated Concrete Pump.
(c) The necessary pressure hose and auxiliary fitments.

A compressor with rotary pneumatic drills and the stand pipes for grouting were provided by the Board.

The first three items mentioned above are part of the equipment used in the Aerocem Process, which provides a method of placing numerous aerated cementitious and non-cementitious materials, either by pump or spray gun, for a variety of purposes, of which the repair of reinforced concrete structures, thermal insulation, fire proofing, steel work, subsoil grouting, injection work and the mechanical repointing of brickwork are typical applications.

Work was carried out on the sites in 1956 during the following periods: Site No. 1 (see Fig. 2), August 23rd—25th inclusive and 27th—29th inclusive; Site No. 2, September 3rd—8th inclusive; Site No. 3, September 10th—13th inclusive.

During these periods one foreman and four labourers were engaged on the work. The plant was retained on the site for a period of three weeks and a skilled operator was provided during the first week by Aerocem Limited to instruct and advise the Board's staff in the use of the plant and the efficient mixing of the grout for impregnation.

The method adopted was as follows: Holes were drilled in the apron at 6-ft. centres, alternative rows being staggered so that the distance between holes remained constant. The holes extended downwards through the mortar bonding the stone blocks or the blocks themselves as the original construction demanded. One inch (1-in.) diameter iron standpipes were then inserted into the holes and properly caulked and when this was complete the pressure hose was connected ready for grouting (see Figs. 2, 3, 4 and 5).

As the work could only be carried out as tidal conditions allowed, the men worked in shifts and the day's grouting was arranged by commencing at the lower end of the apron and working upwards towards the wave wall. By this means the grouting points remained tide-free during pressure pumping and the whole of the apron above the grouting points could be kept under observation.

During the initial stages of the work it was decided to use a "mix" for the grout in the following proportion:—

One ½ bag of cement,
168 lbs. of sand (see footnote).*
½ pint of "Teepol" as a foaming agent.
3 gallons of water.

This gave a mixture smooth to the touch and with the appearance of dirty whipped cream. Proper aeration of the mix is essential and each batch was in the mixer for 5 to 6 minutes. The added "Teepol" produces the necessary aeration of the grout which reduces its weight and viscosity and thereby considerably increases its powers of penetration and travel.

In order to minimise the risk of "blowing up" the apron during pumping operations, a maximum pressure of 75 lbs. per square inch was decided upon, but it was found that where voids existed under the apron the usual working pressure of the

* It is important that the sand should fall within, or near to, the size limits indicated by the grading curves which Aerocem Limited recommend and it is even more important that the sand should be sieved before mixing, because small pebbles and the like will damage the pump and cause blockages in the standpipe and at the cocks. The sand should be sieved directly into the mixer hopper because even a small lump of cohering sand can cause blockage in the delivery pipe.

Grouting of a Paved Earthen Sea Wall—continued

Fig. 6. General lay-out of Plant. Mixer on trestle, pump on wall.

pump was in the region of 20—25 lbs. per square inch. Frequently it was found that water and air were forced up through porous parts of the apron and through hair cracks during the period of grouting and this served as a general guide to the travel of the grout—although the eventual emergence of grout from adjoining standpipes was a more certain indication. It was interesting to note that invariably before the point of ultimate acceptance was reached the percolation of water and air had ceased.

During the operations pressure was allowed to build up to the agreed maximum and then the grout was by-passed back to the pump hopper; a second build up of pressure was then applied and the grout again by-passed back to the pump hopper; if on a third application of pressure the gauge immediately rose to the maximum, the grouting at that particular point was considered to be completed. From time to time hair cracks were observed near the standpipes and when these were noticed the maximum pressure was reduced to 60 lbs. per sq. inch or thereabouts, depending upon whether the cracks tended to open further or not (see Fig. 6).

If acceptance appeared to be nil, as shown by an immediate build up of maximum pressure, the standpipes were cleared to ensure that obstruction was not the cause and a neat cement grout was applied, the mix being 1 bag of cement, ¾ pint of "Teepol" and 4½ gallons of water. The mixture was aerated in the mixer for 7—8 minutes. It was however found that little advantage was gained by using this mix and after the first day or so the standard mix was reverted to. Later on in the work a trial was made by increasing the water content of the standard mix from 3½ to 5½ gallons, but again after careful observation this seemed to have little or no advantage as far as acceptance was concerned and the practice was abandoned.

The experience which was gained by this series of experiments on the three selected sites seems to show that between 8 to 10 lineal feet of the apron, which is 40-ft. in width, can be grouted per working day and with selection of hours of operation to suit tidal conditions. Variations occurred, as would be expected, owing to sub-apron inequalities of material and the size and frequency of the cavities, the actual daily progress being more or less as these inequalities were encountered.

In order to facilitate the removal of the flexible grouting pipe from the rigid standpipe it was found advisable to provide round-away cocks, one on the standpipe itself and one on the flexible pipe, to prevent the operator being sprayed with grout whilst under pressure or when the pipes were disconnected at the end of one series of pumping. It also enabled the operator to check whether it was safe to remove the standpipe prior to sealing the hole without the risk of a "blow back." After removal of the standpipes and caulking, the holes were sealed with cement mortar to which "Tricosal" had been added to ensure quick setting, chiefly to avoid damage by tidal immersion within a limited period.

In order to ascertain whether the grout retained its aerated form, during and after pumping, samples were taken of the various mixes from the mixer itself, the pump and also the standpipes, and these showed that aeration was retained even after pumping with full pressure and travelling under the apron.

Some three weeks after the work was completed arrangements were made to break out parts of the apron on two of the sites. Three holes were tested, two on site No. 1 and one on site No. 3. All the excavations were taken down below the apron to "beach fill" level: On site No. 1 the excavations revealed no "voids" under the apron and the grout had penetrated well into the lower parts of the joints between the blockwork where the original mortar joint was missing (see Fig. 7). Similarly on site No. 3 no cavities were found to be unfilled and, in addition to the consolidation of the joint, a solid core of grout was found just below the top surface of the beach fill. This core varied from 8 to 10-in. in width and 4 to 6-in. in depth and had obviously filled a void which had existed prior to grouting (see Figs. 8, 9 and 10). It was considered that these two

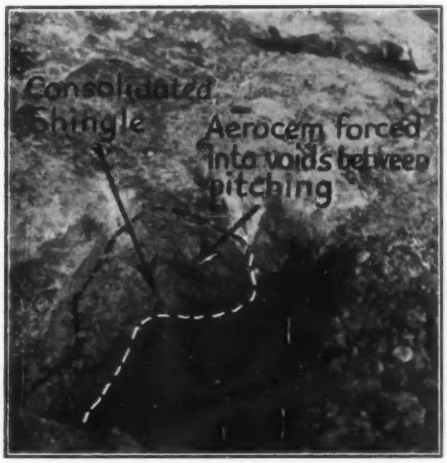


Fig. 7. Trial Hole Site No. 1.

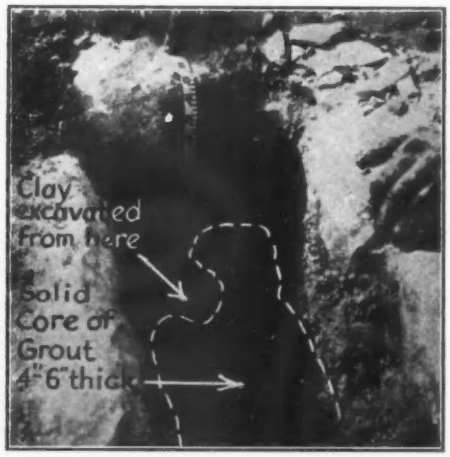


Fig. 8. Trial Hole Site No. 3.

Fig. 9. Trial Hole, Site No. 3.

Fig. 10. Trial Hole Site No. 3.

Grouting of a Paved Earthen Sea Wall—continued

isolated tests were a clear indication of what might be expected under the apron generally prior to grouting being undertaken.

As the work progressed careful records were kept of the volumes of grout which were injected at each grouting point and the travel of grout from each point was traced as previously described and examples of this information together with other statistical information is appended to this article (see appendices A to C). Also the photographs taken during the experiments, and which have been included in the text give a visual appreciation of the method employed.

As with all experiments of this nature, the cost of actually carrying out the work in practice must receive consideration. The author has, with the co-operation of the Engineer of the Kent River Board, been able to obtain the figures which were compiled by the Divisional Engineer in charge of the work. These show that the actual cost per square yard over the sites, and using hired plant, averaged 15s. per square yard and it is estimated that if the Board had purchased its own plant and it was used on the whole length of the wall to its full capacity, this cost could be reduced to 13s. 6d. per square yard, which is a very economical figure.

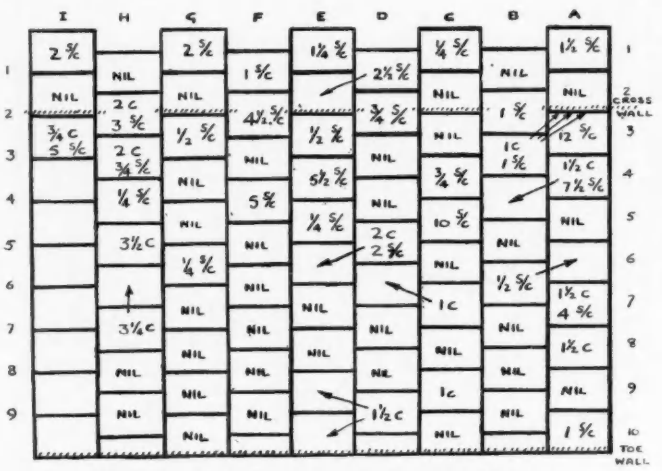
Although the work has only been completed some 12 months at the time of writing this article, and the period has not been one of abnormal storm conditions on this particular length of coast, no damage has been sustained to the grouted apron which has been repaired. It would appear therefore that this type of grouting can be successfully employed where cavities under paved sea defences are suspected.

One of the great advantages of the system is that, normally, where cavities are found to exist, it is necessary to strip the stone pitching or paving—thus exposing an area of vulnerable material to tidal influence so that, however well planned the work may be for the season, if sudden bad weather conditions occur the exposed surface is displaced and becomes scoured. Consequently the cavities are liable to become enlarged with the danger of additional collapse of the protective stone cover. With the grouting system, however, such stripping is avoided and the existing cover is left undisturbed.

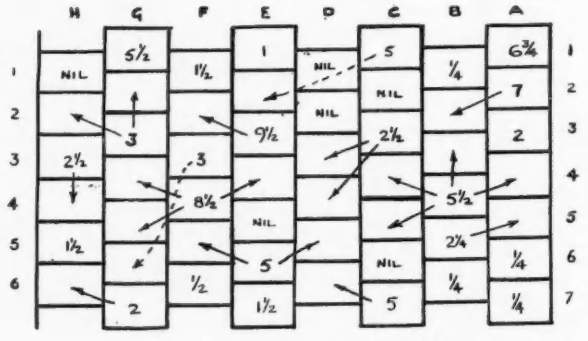
Another great advantage is that in using aerated grout the length of travel and the filling of even the smallest fissure is greatly enhanced. The author has long advocated the use of this method and has confidence that this experiment in Kent will be seriously considered by many engineers who may be responsible for maintaining the hundreds of miles of pitched earthen sea walls, which owing to present day cost are unable to be replaced by refacing, but which from time to time develop cavities which ultimately cause complete collapse.

The author has also had experience in the use of similar plant and methods in the strengthening of a harbour arm on the south coast which was rapidly deteriorating and developing serious cavities. These cavities were successfully sealed with random stone and aerated grout and have withstood the action of storm and tide for several years without any sign of failure. The process has also been used with success in coastal work on retaining walls which have fissured above tidal level. It would appear, therefore, that there is a large field for further work of this kind. The cost involved is only a tithe of the expenditure which would be incurred with complete reconstruction.

In conclusion the author would like to pay tribute to Mr. J. I. Taylor, M.B.E., B.Sc., M.I.C.E., the Engineer to the Kent River Board; Mr. Lake, B.Sc., A.M.I.C.E., the Area Engineer; and Mr. W. Hamill Morton, B.A.I., and the other members of staff of the Board who so willingly co-operated with him in the preparation of the details described in this paper.



Appendix B. Type of Apron—Ragstone Pitching.
Arrows indicate travel of grout.



Appendix C. Type of Apron—Stone Pitching.
During the drilling of the grout holes, more and larger voids were found and the arrows above show where the grout travelled and emerged from adjoining stand-pipes.

DYMCHURCH SEA WALL, GRAND REDOUBT TO WILLOP SLUICE

Experimental Grouting by Aerocem Process

Summary of Work: Duration, 3 weeks; Labour, 1 Foreman, 4 Labourers; Materials used, Cement 6 tons, 16 cwts; Sand 12 cu. yds. approx.

Appendix A

	Site No. 1	*Site No. 2	Site No. 3
Type of Apron	Stone pitching	Concrete stepwork	Stone pitching
No. of Mixes	98 (392 cu. ft.)	72¾ (291 cu. ft.)	82 (328 cu. ft.)
No. of Holes	79	57	52
Average acceptance per hole	5 cu. ft.	5 cu.ft.	6.3 cu. ft
Maximum acceptance per hole	48 cu. ft.	62 cu. ft.	38 cu. ft.
Average depth of grout over site	0.155-ft.	0.14-ft.	0.2-ft.

KEY—

Appendix B—Site No. 1.

S/C means SAND/CEMENT MIX (3 : 1 mix).
C means NEAT CEMENT MIX.

ANALYSIS—

Area of site (rows A to H inclusive) = 42-ft. x 60-ft. = 2520 sq. ft.
No. of mixes: 22 neat cement + 76 sand/cement = 98
Quantity pumped = 98 x 4 = 392 cu. ft.

Average thickness of grout over site

$$= \frac{392}{2520} = 0.155\text{-ft.}$$

Maximum acceptance at one hole = 48 cu. ft.
Average acceptance per hole = 5 cu. ft.

Appendix C—Site No. 3.

All grout of 3 : 1 Sand/Cement Mix.

ANALYSIS—

Area of site 43-ft. x 39-ft. = 1677 sq. ft.
No. of mixes: 82.
Quantity pumped = 82 x 4 = 328 cu. ft.

Average thickness of grout over site

$$= \frac{328}{1677} = 0.2\text{-ft.}$$

Maximum acceptance at one hole = 38 cu. ft.
Average acceptance per hole = 6.3 cu. ft.

Correspondence

To the Editor of "The Dock and Harbour Authority."

Dear Sir,

Marine Surveying at the Port of Newcastle

I trust you will permit me to add a few remarks to the interesting paper by Mr. McClean published in the February issue of your journal, especially as he quotes an earlier paper of mine.

Refractive Error

Under this heading Mr. McClean quoted a suggestion of mine in a 1953 article—that to minimise the error caused by a parallax in a sextant, it should be calibrated for a mean distance. This early suggestion is now no longer applicable as it is now established practice to increase the distance between the zero and the rest of the subtense board calibrations by the parallax distance of the sextant. This distance represents the separation between the index mirror of the sextant and the line of collimation, usually 0.177-ft. Thus a simple additive constant to the calibrated subtense board measurements allows a sextant, conveniently calibrated on infinity to be used without introducing any instrumental errors.

Sounding Errors

In his description of slope errors Mr. McClean assumes the polar beam spread of the echo to be a cone of definite angular dimension which he defines at 15° from the vertical, and that when sounding on slopes the echo will reflect from the highest part of the bottom within the cone, giving a shallower sounding than the true vertical sounding. This is not strictly the case, since for all practical purposes the main strength lobe is quite narrow and is increased in area to a roughly conical shape by areas of diminishing intensity until it fades out completely. It will thus be appreciated that stronger returning echoes will be recorded from the vertical or main strength area, with signals of decreasing intensity from areas towards the extremities. Thus by reducing the sensitivity of the receiver it is possible to eliminate the reception of the weaker outside echoes and record only the stronger echoes from beneath the oscillator. When sounding in such conditions, therefore, the sensitivity control should be set so that only a weak but readable trace is obtained; the soundings then recorded will be as near to the vertical as it is possible to obtain. A strong recorded echo on a high sensitivity setting on the other hand, would, by recording the weaker extremity echoes, give an appreciable shallower sounding. These facts can easily be demonstrated by placing the oscillator 5-ft. off a vertical jetty face in relatively deep water. Using maximum sensitivity an apparent and erroneous shallow bottom would be recorded; which, in effect, would be the echoes off the side of the jetty. If the sensitivity is then reduced gradually the apparent recorded bottom would deepen until a point was reached when the true bottom was recorded free from interference from any echoes off the face of the jetty.

Silt in Suspension

In conclusion, when referring to the effects of silt in suspension, Mr. McClean suggests that use can be made of the decay and voltage controls. I cannot see how any adjustments of these pre-set controls can have any beneficial effect; since these are settings for the initial suppression circuit. Their use, as suggested therefore, would cause the initial suppression to operate over a much greater depth band than intended. Thus if these controls are adjusted to give the desired results of suppressing out weaker signals at a certain depth all shallower recordings would be completely unreliable; either by the returning signal being suppressed out completely or partly suppressed giving a "murky" effect which would originate in the receiver itself and not from silt in suspension for which it could be mistaken. Once again, the elimination of unwanted weak echoes is best achieved by the use of the sensitivity control.

30, Newberries Avenue, Yours faithfully,
Radlett, Herts. A. D. MARGRETT.
5th March, 1958.

New Dry Dock at Falmouth

Details of Equipment Used for Excavation

Details were recently published by the Federation of Manufacturers of Contractors' Plant regarding the progress of the construction of a new dry dock at Falmouth in Cornwall. When completed, the facilities will also include a platers shop and ancillary servicing facilities.

Excavation for the new basin has required the cutting back of the former cliff line, a quarrying operation involving the removal of 250,000 cu. yards of shale, whilst excavation for the body of the dock basin has necessitated the removal of a further 250,000 cu. yards. Removal of this volume of material has been effected by preliminary drilling and blasting, after which the rock has been loaded by the excavators into dump trucks.

In the quarrying operation, required to provide the extra length for the new dock, eighteen Holman rock drills were in use, drilling an average of 3,000-ft. per week. The face was carried back in two steps, holes being spaced some 8-ft. apart with 6—7-ft. burden. The bits used were 2¼-in. dia. push-on type bits using a copper thimble and tapered rod end. The steel was ⅞-in. hexagon and was supplied with the tapered end scored to

Fig. 1. General view of dock excavation.

give greater holding power, resulting in the elimination of loss of bits. Drill steel breakages were rare, a point attributed to the high drilling rate achieved at the relatively low air pressure of 90 lb./sq. in. at the face. At this pressure, little damage was transmitted to the steels, especially when they became jammed in the fractured and fissured shale. Compressed air for this section of the work was derived from the company's ring main servicing the dockyard, this being maintained by a battery of static Holman compressors. Loading the broken stone at this stage was an excavator fitted with a 2½ cu. yd. capacity bucket, mounted on standard tracks 15-ft. in length. A fleet of four 15 cu. yd. rear dump trucks fitted with sideboards was employed, completing a round haul of 1,000 yards in 10 minutes. Final trimming of the cliff face was effected by carrying a 5-ft. wide ledge down from the top, using pneumatic breakers and air picks.

Prior to the start of the dock excavation, a coffer dam 380-ft. long and 30-ft. wide was constructed of Larssen type piling, with the coarse sand fill derived from dredging. On completion of this dam, the first cut for the dock was made, this being opened out from an inclined ramp at the side of the excavation. A general view of the dock excavations is shown in Fig. 1. At the height of operations, three excavators were in operation.

The fifteen ton dump trucks, used in conjunction with the excavators, are of standard type incorporating a double acting three stage hydraulic hoist capable of raising the loaded body

New Dry Dock at Falmouth—continued

in under ten seconds. The dumping speed is engine controlled and of particular use on this project, where a large tonnage of aggregate and sand has also to be handled, is the high dumping angle, a feature which gives a clean load discharge. As dumping of the aggregate is over the rough edge of the excavation (Fig. 2) the clearance of the chute from the rear wheels allows tipping to take place directly over the edge of the dock excavation without any attendant risk being incurred through backing up too close.

Aggregate and sand are shipped direct to the docks in coastal vessels and are discharged by crane operated grabs. A stockpile of material is maintained on the floor of the new dock and from here the material is fed to a weighbatcher, which supplies correctly batched mixes to two concrete mixers, mounted on blocks to facilitate discharge to dumpers. The weighbatcher is fed by a bucket elevator which forms an integral part of the equipment (Fig. 3). In designing this unit, the manufacturers have arranged for the buckets to follow a triangular course, so that after discharge to the appropriate hopper, the buckets descend to the aggregate pile and then follow a horizontal course along the top of the stockpile before turning again to rise up to the hopper. An operator at the turning point controls the lateral swing of the bucket elevator, which is designed to traverse round the weighbatching unit in a 230° arc. The aggregate bin is divided into three compartments for aggregate which correspond to the three divisions of the stockpile. Capacity of the loader is 45 cu. yards per hour. Raising and lowering of the elevator to negotiate the stockpiles and the dividing walls is controlled by the operator through a hydraulic ram.

Cement is delivered in bulk to a 90 ton capacity bulk cement silo, the bulk transport deliveries being made into a shallow ground receiving hopper. In the batching section, the aggregates and cement are weighed in a common bottom discharge weigh hopper of 26 cu. ft. capacity. The weight of each constituent being progressively recorded on a marked dial incorporating adjustable pointers which can be set for any desired amount. The hopper is fitted with a radial gate controlled by a trip lever actuated by the edge of the mixer skip to which it discharges

Fig. 2. Good rear wheel clearance allows the 15 ton Euclid dump truck to achieve clean discharge over the dock wall.

and may be slewed through 180° to service the two Stothert and Pitt mixers which are placed side by side.

For emplacing the dock wall, concrete conveyance is by skips carried on flat bed dumpers, gate operated discharge hoppers being incorporated in the mixer layout to facilitate loading of these units. The skips are transported to the pouring point and are then hoisted by crane to discharge their load behind Acrow unit type shuttering. Emplacement of the concrete for the pumping station and main dock floor will utilise a 6-in. pneumatic placer and a 4-in. concrete pump. Holman vibrators and pneumatic compactors are used for vibrating the concrete.

On completion of the work on the new dock basin, a new box-type dock gate will be fitted at a cost of £110,000. This dock gate will, it is believed, be the largest ever constructed of this type. The pumping units which will be installed will be capable of emptying the dock in $2\frac{3}{4}$ hours and will comprise three new pumps, each of 700 b.h.p. and each capable of pumping 15,000 tons of water per hour. Sodium arc lamps will be fitted into the sides of the dock to make work on the ship's sides and bottom

Fig. 3. The Blaw Knox universal weighbatcher fed by bucket elevator.

safer, quicker and easier, and there will also be separately operated bilge blocks which will replace the outdated breast shores to ensure safe settlement of ships. Subsidiary pumps, capable of dealing with 2,000 tons of water per hour will also be fitted to deal with the drainage of water ballast.

The new dock will provide a required length of 850-ft. with proper access from the harbour and will be capable of accommodating ships of 60,000 tons or so now being built to carry oil.

Construction is being carried out by the Falmouth Dock and Engineering Company under the direct supervision of the company's resident Director and General Manager, Mr. A. E. Underwood, A.M.I.C.E., the chief civil engineer for the scheme being Mr. J. D. Norfolk, A.M.I.C.E., A.M.I.Struct.E.

The Larssen type piling for the coffer dam was supplied by the British Steel Piling Co. and was driven by a McKiernan Terry BSP hammer operated from a derrick. Holman bits and drills, vibrators and compactors were used and Ruston Bucyrus supplied the excavators.

New Oil Tanker Accommodation at Tranmere, Birkenhead

A new terminal for oil tankers is to be constructed for the Mersey Docks and Harbour Board. The works include reinforced concrete viaducts and pipetracks terminating at two steel pontoon floating berths, each about 370-ft. long by 60-ft. wide; these will simultaneously accommodate two 100,000 tons deadweight tankers. This is the first time so large an installation will have been built by a major Dock Authority in the United Kingdom. The floating berths are restrained by steel lattice booms which incorporate gravity energy absorbers at their anchorages. Six specially designed steel mooring dolphins are provided at each berth. The main contractors, Messrs. Peter Lind & Co. Ltd., have sub-let the construction and installation of the floating berths, booms and dolphins to the Cleveland Bridge & Engineering Co. Ltd.; the consulting engineers for the design of these marine works are Posford, Pavry & Partners of London.

Accidents to Personnel in Dry Docks

Obligations under the Shipbuilding Regulations

By LAURENCE WEBLEY, LL.B

The scope of the protection afforded by the Shipbuilding Regulations 1931 to persons employed on a ship under repair in a public dry dock has recently been considered by the House of Lords, in the case of Canadian Pacific Steamships Ltd. v. Bryers. The question "who is protected by the regulations?" is of interest to Dock and Harbour Authorities hiring dry docks in view of the obligation, under the duties specified by the regulations, upon persons having the general management or control of public dry docks to comply with regulations as to the gangways, uprights, thwarts and planks which they provide at such docks and with certain other rules, especially as to the lighting of the quays around the docks.

Bryers was a yeoman carpenter employed by the defendants in their ship the "Empress of Scotland." This vessel was put in a public dry dock owned by the Mersey Docks and Harbour Board, under contract with the Board, for her annual survey and overhaul. Nearly 20 contractors were working on the vessel. Her scuppers and bilge openings had been covered with cement to facilitate the carriage of a grain cargo on the last voyage, and Bryers had the task of removing it. Whilst on F deck he slipped, fell into the well, and was injured. He claimed the well should have been provided with stanchions and life lines around it. The relevant regulation provided that where a ship was being repaired in a public dry dock, if the control of the ship, apart from the repair work, remained with the ship owner, it was his duty to provide protection for hatches or openings. The shipping company contended they were not, in the circumstances, under a duty to observe this regulation and also that Bryers was not in the category of persons covered by the regulations.

Their Lordships said that while the regulations laid down certain matters as being the duty of the "occupiers," the substitution of a national occupier was not essential to their being in force. They indicated a practical and sound allocation of duties between those in control of the dock and those in control of various parts of the ship whoever was the occupier.

It was further argued that the regulations only applied to protect persons engaged on the construction and repair of the ship and Bryers was not so engaged. They were not intended to protect persons wholly unconnected with the construction or repair of ships and not even employed by a repairing contractor. However, there was nothing in the regulations, declared their Lordships, inconsistent with the view that the crew of the vessel were included. Both workmen and crew worked together in a ship exposed to all the changes and dangers entailed by the repairing process. It was within the powers of the Secretary of State to make regulations in respect of persons so employed whether they were actually engaged in the repair process or not. A ship undergoing repairs in a dry dock was regarded as a factory in which dangerous work was being done. A member of the crew was one of the factory maintenance staff and if his work required him to be in the danger area there was no reason why he should not be entitled to the benefit of this particular safety regulation.

Accordingly, the court dismissed the shipowners appeal that they should not be held liable. It seems clear, therefore, that, in general, the Ship Building Regulations apply to the crew employed in their ship in dry dock whether they are doing repair work or not and any obligations imposed on Dock and Harbour Authorities under the regulations are as much for the benefit of such crew members as for contractors' workmen engaged in actual repairs.

Manufacturers' Announcements

Fork Lift Trucks for Cargo Handling on Board

A further attempt by the Union-Castle Line to expedite the loading of their ships in port was seen in the Port of London early this month when fork-lift trucks were used simultaneously in the lower holds and 'tween decks of the "Kenilworth Castle." The cargo included 1,200 tons of tinplate, cars and crated car parts.

Tinplate was loaded without the age-old problem of dragging. A fork-lift truck stowed the uniform stillage packs of tinplate two deep along the entire 'tween deck. This formed a false floor on to which cars were later moved. In the lower hold, an 8,000 lb. fork truck stowed 3-ton crates of car parts. Safer, higher stacking was achieved and plans are already in hand to use a truck with a lift of 16-ft. It is claimed that, through quicker handling and higher stacking, more cargo was stowed in the hold than ever before. The use of the trucks also increased the earnings of the dock workers who were being paid tonnage rates. For the Union-Castle Line, most notable results were the cuts in damage bills and increased tonnage stowing. The various trucks were supplied by the Yale & Towne Manufacturing Co., Wednesfield, Staffs.

Reconstruction Works at Runcorn Docks

The £24,000 contract placed by the Bridgewater Department of the Manchester Ship Canal Company with Messrs. A. Monk & Co. Ltd., Warrington, for reconstruction of Flint Wharf, Runcorn Docks, has now been completed.

The Dock wall has been replaced by 40-ft. lengths of steel sheet piling for a distance of 270-ft. and at the same time the crane track has been raised to the level of the adjoining storage ground involving considerable concreting.

New electric transportable cluster lighting has been prepared for use at the new wharf. The reconstruction work envisages use of mobile cranes for ship discharging to supplement the grab cranes at this wharf.

Before the reconstruction work at Flint Wharf could be commenced last autumn Fenton Wharf in the inner dock was reconstructed by the Canal Company's Engineering personnel, providing a large area of concrete decking to facilitate use of mobile cranes at this berth, and to enable vessels to be discharged there whilst Flint Wharf has been out of action.

The two new discharging berths now available for vessels up to 1,200 tons capacity is in continuation of the policy of the Canal Company to modernise Runcorn Docks for the more expeditious handling of pottery materials, fertilisers, chemicals and general cargo.

When the Runcorn/Widnes Bridge is completed Runcorn Docks will be easily accessible to Lancashire and the North as is at present the case to places in Cheshire, Staffordshire and the Midlands.

The Docks are managed by the Bridgewater Department of the Canal Company.

Launching of H.M. Tug Griper

H.M. Tug "Griper," the fifth of the seven new diesel electric paddle tugs ordered by the Admiralty, was launched recently from the yard of Messrs. Wm. Simons & Co., Ltd., Renfrew.

Though primarily for harbour service, the new tugs conform to Lloyd's Class 100 A.1. for towing and salvage services. Paddle driven tugs are found by experience to be the most suitable for moving aircraft carriers and other large warships in the confined waters of dockyard basins. To enable them to operate under the overhanging sides of aircraft carriers, hinged masts are fitted as well as squat funnels and raked back stems.

The propelling machinery consists of four diesel generators connected in series with two independent propulsion motors. The paddle wheels are of the feathering type with star centre arranged inboard and on the paddle block.

Accommodation is provided for six officers and fifteen crew. The overall dimensions are, length 157-ft. and breadth 60-ft. Displacement, load 710 tons.

International Sales Convention on Cranes

An international convention to be held at Scarborough from 27th April to 3rd May has been organised by Steels Engineering Products, Ltd., of Sunderland, who design, manufacture and market "Coles" mobile cranes. It is expected that more than 100 distributors and sales agents will attend the convention at which there will be films and demonstrations of Coles equipment, lectures on materials handling, crane selling techniques and future trends in design. There will be free discussion sessions on all sales and service topics and problems.

More than 50 per cent. of the company's production is exported to all parts of the world, and it is claimed that they are the only British mobile crane manufacturers selling in the U.S.A. The Company operates manufacturing plants in Australia, Western Germany and the U.S.A.

Use of New Preservative against Corrosion

Our attention has recently been drawn to an example of the positive results obtained by using Caltex Rustproof Compound L as a preservative under the most severe conditions of corrosion by immersion in sea water and exposure to atmosphere. The application concerns the pier at Ilfracombe in North Devon, which has been fitted with hydraulic buffers carrying the vertical wooden fenders for ships coming alongside.

Rustproof Compound L was applied to these hydraulic buffers and to various other metal fittings on the pier structure in April, 1957, and, on inspection in late September, it was ascertained that no deterioration or corrosion had taken place during this time and an adequate coating of the preservative still remained. The quantity of the Compound used for this purpose is, of course, small, but it is worthy of note that the claims made for the product were fully borne out in practice. The preservative is marketed in the U.K. by the Regent Oil Co. Ltd., London.

Thermal Insulation Exhibition, April 14-19

More than 50 leading firms and associations will be represented at the Thermal Insulation Exhibition at Earls Court, London. This Exhibition, which is the first of its kind, is being run in conjunction with the 6th Factory Equipment Exhibition.

Demonstrations have been arranged of diverse insulating materials and methods including wood wool slabs, asbestos cement sandwich constructions, gypsum plasterboard, asbestos spray, insulating bricks, multiple glazing units, hollow glass blocks, precast floors, fibreboards, corkboard, expanded plastics, glass fibre, asbestos mattresses and double glazed windows.

During the exhibition a one-day conference on the Thermal Insulation of Factory Buildings will be opened by Mr. Gerald Nabarro, M.P., who was the originator of the Thermal Insulation (Industrial Buildings) Act, 1957, which provides that all industrial buildings erected after January 1, 1959, shall be regulated against loss of heat to a standard prescribed in regulations laid down by the Minister of Power.

The purpose of the conference is to explain to those concerned with planning industrial buildings what they are required to do, how much it will cost and what benefits will result.

Dr. F. M. Lea, C.B.E., Director of the Building Research Station, will be chairman during the morning session when Mr. W. J. Dickie, A.M.I.Mech.E., M.Inst.F., of the Federation of British Industries will speak on "The Meaning and Implications of the Thermal Insulation (Industrial Buildings) Act 1957." Mr. H. C. Crump, Taxation Adviser, Federation of British Industries will speak on "Financial Considerations Arising from the Act."

Sir Edward Herbert, O.B.E., M.A. (Cantab.), A.M.I.C.E., M.I.Mech.E., M.I.E.E., F.I.I.A., Director of the National Industrial Fuel Efficiency Service, will be chairman during the afternoon session when Mr. G. D. Nash, A.R.I.B.A., T.P. Dip., of the Building Research Station, will speak on "Planning the Insulation of Buildings."

APPOINTMENTS VACANT

TRAFFIC OFFICER/INSTRUCTORS are required by the NIGERIAN PORTS AUTHORITY. Candidates must be men of matured experience aged 45 or above or with at least twenty years' practical experience in quay/shed work in a large scale port organisation. They must be of a keen and energetic disposition and have requisite capacity and temperament for training Nigerian Staff. Knowledge of all aspects of cargo handling essential, including some years' practical and supervisory experience in shed/quay work, customs and other documentary procedures and the use of mechanical handling equipment.
Successful candidates will be appointed on a contract basis for two or three tours. Salary will be £2,000 per annum consolidated with eligibility for a gratuity at the end of the period of service.
Tours normally 12—15 months. Leave on basis of seven days for every completed month of service. Free first-class passages for officer and wife. Additional passages and allowance for children. Furnished accommodation at reasonable rental. Car allowance and free medical attention
Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M3B/43712/DU.

TYNE IMPROVEMENT COMMISSION

The Tyne Improvement Commissioners invite applications from qualified persons for the positions of:—

(a) ASSISTANT CHIEF ENGINEER and
(b) SENIOR ASSISTANT ENGINEER

under their Chief Engineer, Mr. R. B. Porter, M.I.C.E.
Applicants for each position must be Chartered Civil Engineers with extensive experience in the design, construction and maintenance of dock and harbour works and installations.
The commencing salary, which will have regard to the qualifications and experience of the successful candidate, will be: for the position of Assistant Chief Engineer not less than £2,100 per annum; for the position of Senior Assistant Engineer not less than £1,650 per annum.
Applicants must not be less than 32 years of age nor more than 45 years of age on the 1st January, 1958.
The person appointed will be subject to the provisions of the Commissioners' Superannuation Scheme; will be required to reside in the district and to devote himself exclusively to the service of the Commissioners.
Applications on a prescribed form, copies of which may be obtained from the undersigned, will be received up to the 10th April, 1958, and should be addressed to the Secretary endorsed to indicate the position for which application is made.
Canvassing will be a disqualification.
Bewick Street, Newcastle upon Tyne, 1.
R. N. EGGLETON, Secretary.

FOR SALE

35 TON ELECTRIC PORTAL WHARF CRANE. Capacity 35 tons at 60-ft. radius. Lift 70-ft. above and 30-ft. below rail level. Gauge of portal 40-ft., admitting 3 lines of standard gauge track. Equipped with automatic tipping cradle to carry standard 16 ton railway wagon. Electrics 400—3—50 with Ward-Leonard Generator for lifting and tipping gear. Built 1945. Perfect order and condition. Reed Brothers (Engineering) Ltd., Replant Works, Woolwich Industrial Estate, London, S.E.18. Telephone: Woolwich 7611/6.

14,000 lb. FORK-LIFT TRUCK, 18-ft. 3-in. height of lift. In good working condition. — B. G. PLANT (SALES AGENCY) LTD., Watlington, Oxfordshire. Telephone: Watlington 44.

RAILWAY DIESEL GENERATOR VAN. Standard gauge, long wheel base 4-wheel van. Complete 27.5 K.V.A. Ruston Hornsby Alternator set, 400 volt, 3 phase, 50 cycles and 24 volt storage battery charging. Brand new as from makers; £950.—Dawson-Keith Ltd., Hillview Road, Sutton, Surrey. Telephone: FAIrlands 4401.

WANTED

Reconditioned second-hand hydraulically-operated 6,000 to 8,000 lb. petrol driven FORK-LIFT TRUCK. 10 to 12-ft. lift. On Solids.—Box No. 208, "The Dock and Harbour Authority," 19, Harcourt Street, London, W.1.

10,000 lb. FORK-LIFT TRUCK, maximum height 11-ft., maximum width 6-ft.—Box No. 206, "The Dock and Harbour Authority," 19, Harcourt Street, London, W.1.

BALL AND ROLLER BEARINGS, ETC., WANTED! Also surplus goods —especially hand tools—of all descriptions. For Sale: METAL BOXES of strong and sturdy gauge and construction with handles in all sizes.—Ask for details, R. Pordes, 138, New Cavendish Street, London, W.1. MUSeum 5250.

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Second-hand
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